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VIEWS, NEWS AND INTERVIEWS.

The International Electrical Congress at Frankfort-on-the-Main has been dubbed the "High Tension" Congress, not only because 100,000 volts are calmly discussed, but because the work of the Congress has been carried on at a high pressure.

The Victorian Electrical and Telegraphic Journal, published in London, has come to an untimely end through lack of support, after an existence of five years.

Zeno the Eleatic, the double-tongued, the all-confuting, held that motion was simply the product of men's imaginations; that things merely seem to move, and do not actually do so. He supported this position by this sophistry:

"Motion is supposed to be in space. Then, if it exists, it must exist in some place. But a thing cannot move in a place where it is. Neither can anything move in a place where it is not. Motion is, then, impossible."

Jules Verne has been speculating as to what will be the daily life of people 1,000 years hence. Nothing will satisfy M. Verne but aerial trains traveling at the rate of 625 miles an hour, a transatlantic tubular service, conveying the traveler from London to New York in 295 minutes, a "telephote," which enables persons in different hemispheres to dine with each other, or, at least, to see and converse with each other while eating, and accumulators for condensing and radiating at will the sun's rays. Such are the advantages to be enjoyed by the inhabitants of a certain city called "Universal City," the capital of the United States in the year of grace 2891. The public will be kept informed of the latest political developments, not only upon the terrestrial globe, but upon Jupiter, Mars and Venus. The newspaper of the day will be spoken. Brilliant descriptive writers will be retained to speak through the telephone to millions of subscribers, and daily instalments of novels, to be continued to-morrow morning, will be given by popular authors.

Robert J. Parks and Fred. J. Flynn, the New York telegraph operators who were arrested recently at New Haven, Conn., for tapping the Western Union Telegraph wires so as to beat a New York turf commission house, will be prosecuted under a law which was passed as the outcome of the Ingersoll-Trowbridge divorce case two years ago. When Colonel Trowbridge set about to get evidence against his wife, tips were secured by tapping the telephone wires between his home and the office of Jonathan Ingersoll, the co-respondent. Most of the evidence of infidelity was obtained in this way, but it created so much comment that the legislature of 1889 passed a law forbidding wire tapping. There have never been any prosecutions under it until the present case.

A lunatic was arrested a day or two ago in New York who believed himself to be a walking telephone. As he walked along he occasionally placed one of his coat-tails to his mouth and shouted some question, and then would hold the other coat-tail to his ear to listen for an answer.

A Visit to a Great Engine House.

A representative of the ELECTRICAL REVIEW found Col. Gardiner C. Sims in his comfortable office at Armington & Sims' big engine manufactory, Providence, R. I., Wednesday of last week.

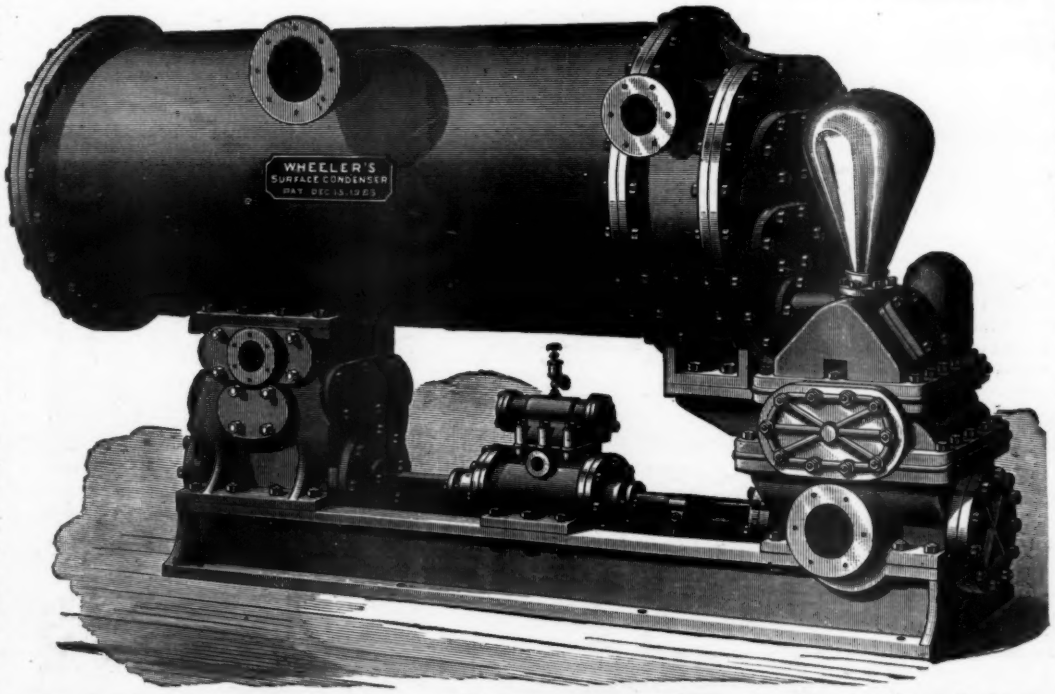


FIG. 1.—WHEELER'S SURFACE CONDENSER WITH INDEPENDENT AIR AND CIRCULATING PUMP.—IN USE IN ELECTRIC LIGHT AND POWER STATIONS.

"Are you building any engines these days?" was asked.

"There are exactly 179 engines in course of construction here now," replied Commissioner (World's Fair) Sims.

"May I say 180, Colonel—I think it will sound better?"

"No, indeed, this establishment can never be led away from the paths of truth—for only one engine."

The appearance of the immense factory easily substantiated the statement of General Manager Sims. Among the engines in course of construction seen by the REVIEWITE were two of 150 horse-power each for the Edison lamp works at Newark, N. J.; two of 250 horse-power, double compound, to be shipped to Waltham, Mass., for the use of the gas and electric company of that city, where four of 60 horse-power are already in use; one of 500 horse-power for the electric light company at Brookline, Mass.; two triple compound engines of 500 horse-power each for the Edison Company at Easton, Pa., for lighting and railway work; one of 450 horse-power for the Springfield, Mass., Electric Light Company.

A conspicuous feature of the extensive engine building to be seen on all sides was a 200 horse-power double upright compound engine, being built for Fred. A. Gilbert, at Boston, to be used in his new electric light station. These engines take up very little room indeed, and have evidently pleased the keen eye of President Gilbert, of the Boston Electric Company, for he is having 26 of them made.

Another special engine is one for the United States Monitor "Miantanomah," with direct connection to the Thomson-Houston dynamo. This has been accepted and was being made ready for shipment.

It will be of interest to manufacturers generally to learn that by the use of improved milling machinery, Messrs. Armington & Sims are enabled to vastly increase their output, in many instances increasing it ten-fold. There is, probably, no better engine shop in the world in the matter of fine and modern machinery. One company (Manning, Maxwell & Moore, New York) has sold Messrs. Armington & Sims, this season, over $80,000 worth of improved machinery. The shops are kept very clean, well ventilated, and may be considered models of their kind.

Electrocution News.

The appeal of Nicola Trezza, the Kings county murderer in Sing Sing prison under sentence of electrocution, in his action against A. A. Brush as warden of Sing Sing prison, was argued October 5 in the Court of Appeals, at Albany. The appeal is from a judgment of the general term affirming an order of Justice Cullen refusing to discharge Trezza from imprisonment at Sing Sing and dismissing the writ of *habeas corpus* granted on his petition.

Wheeler's Improved Surface Condenser.

The Wheeler surface condenser, with independent system of air and circulating pumps, is shown in the accompanying illustrations. A minimum amount of floor space is occupied by this condenser, as it is mounted above, and firmly bolted down to, the pumps, the latter serving as a foundation. This arrangement also accomplishes a saving in piping between the pumps and the condenser. Referring to Fig. 2, the water power delivers the circulating water through the nozzle *c*, directly into the lower section of tubes in the condenser, thence the water flows through *e* into the chamber *h*, passing into the upper group of tubes and discharging through the outlet nozzle *d*, as shown by the arrows.

The exhaust steam enters at the nozzle *a*, and comes in contact with the scattering plate *o* and distributes uniformly over the cooling surface of the tubes. The water of condensation gravitates to the bottom of the condenser and flows directly to the air pump by the annular passage *b*. The air pump discharges the water through the outlet nozzle at the side of the cylinder. Both pumps are operated by a direct acting steam cylinder.

In this device very thorough arrangements are provided for the expansion and contraction of the tubes, and this without using tube packings of wood or paper. There are no ferrules, washers or packings of any kind used. The tubes are seamless drawn brass, tinned inside and out. They are arranged in pairs, with the smaller tube inside the larger. The outside tube is thickened at one end on which a deep thread is cut. This end of the tube is screwed into a brass head, and on the other end of the tube is screwed a cap. One end of the small tube is also drawn thick and a thread chased on it. This tube is also screwed into a brass head. The tubes can be easily taken out and thoroughly cleaned.

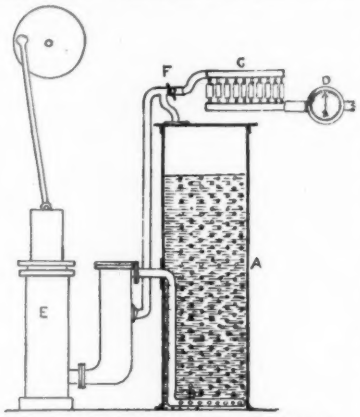
The tightly screwed fastenings also permit the use of circulating water under pressure. The circulation is very thorough, and, consequently, the smallest amount of cooling water is required; this enables a large saving to be made in the power for the circulating pump.

The condensers are made with bodies of both circular and rectangular shape—the larger sizes are usually of the latter design. Wheeler surface condensers are in use in some of the largest electric plants in the country, including the West End Street Railway Company's power house in Boston. The Edison Company has adopted the Wheeler condensers, as have also many large engine builders. This device is manufactured by the Wheeler Condenser and Engineering Company, Nos. 92 and 94 Liberty street, New York.

Experiments in the Purification of Water for Drinking and Manufacturing Purposes.

BY J. C. DITTRICH.

In view of the developments regarding the Croton water supplied to the city of New York, which, according to the reports of competent authorities, contains organic matter, which, although perhaps not immediately dangerous to the public health, is present in sufficient quantity to give rise to grave apprehensions, especially in cases of atmospheric or other conditions favoring the spread of epidemics, I think it is not out of place to call attention to my experiences with a new method of purifying and sterilizing water. The result of a series of ex-



APPARATUS FOR OZONIZING WATER.

haustive experiments with this new process have proved that it is possible, at a moderate cost, to render bad and contaminated water pure and fit, not only for the purposes of manufactures, in which pure water is a necessity, but, what is still more important to the public in general, fit for drinking purposes. The agent employed in this new method of purifying water is ozone, which is the most powerful known oxidizer, and its employment for the destruction of bacteria in water has met with complete success.

Careful experiments demonstrate that the destruction of noxious or loathsome substances or their conversion into harmless bodies is effected by the ozonization of water. The ozone decomposes sulphuretted hydrogen into sulphuric acid and water, transforms ammonia into nitrate or nitrate of ammonia, precipitates the iron, if present, as ferric hydrate and, finally, kills the bacteria generating decay. Observation has established the fact that the very worst water can be made drinkable by the process of ozonization. Disinfection by ozone is different from any other method. Ozonization is quicker and cheaper than sterilization by boiling, and as it leaves no traces behind it in the water, it has decidedly the advantage over chemical disinfection, such as is brought about by sulphuric acid, chlorine, etc. Doubtless the water absorbs some ozone (in preparing ozone water for medical purposes a special method is employed by which more ozone is absorbed), but so insignificant in amount that it is not perceptible to the taste. The ozone simply passes through the water, does its work, *i. e.*, renders noxious substances harmless, kills the bacilli and leaves the water without communicating to it anything of a deleterious nature.

The following experiment, illustrating a test for the sterilization of water, is interesting. Some sterilized nutrient gelatine being placed in a sterilized reaction tube, a little of the water to be tested is dropped on the gelatine by means of a sterilized platinum wire, the mouth of the tube being closed with a plug of cotton wool. If the water contains bacteria their cultures become visible within 48 hours, in the form of opaque grains and tubercles which continue to multiply. If the water be perfectly sterilized the gelatine remains quite free from the development of bacteria cultures. Although such experiments prove the sterilization of the water by ozone, there is still some slight uncertainty if the less common bacteria, viz., those generating disease, typhus, cholera, anthrax, etc., and their spores are completely destroyed. The determination of this question is fenced about with so many difficulties that it can only be determined by experts, although there is every indication at hand that it will be solved in a manner entirely favorable to ozone.

As ozone does not affect the solid mineral and earthy matter held in suspension in water, filtration by ordinary methods will be a necessity in the ozonization process, in order to remove such matter. The object of filtering plants hitherto in operation, has been not only the removal of the solid matter in suspension, but also the collection, as far as possible, of the bacteria, and this is generally effected by means of the growth of algae, which takes place on the surface of the layer of filtering material. The services of the algae for this purpose are entirely superseded by the ozonization process, which removes the bacteria in a much more complete manner—by killing them. Actual experiment has demonstrated that algae cannot survive in ozonized water; therefore, the onerous labor of periodically turning over the filtering layer to prevent the growth of algae from becoming too thick, is entirely done away with.

It has not yet been possible to fully determine the actual amount of ozone absorbed in passing through the water. Larger apparatus will, however, shortly be constructed, which will serve as models of water ozonization and from which the effective power and cost of the process can be established.

Only after the cost of the ozonization process for the purification of water has been exactly determined, can its merits be properly discussed, nevertheless, so far, so much is apparent, that the principle is one, the consideration of which cannot be laid aside, particularly in cases in which good drinking water is only obtainable at great cost, bad drinking water on the other hand easily procurable, but by ozonization purified and converted into good.

So far I have considered the ozonization process in reference to the production of pure and healthful drinking water, which in itself is a question of prime importance. The question further arises as to the applicability of the process to the purification of water for manufacturing purposes, by removing the iron, etc., by precipitation. This is a matter which concerns perhaps more especially paper manufacturers. As I have stated, ozonization effects the removal of iron present in water. Another point worth consideration is the purification by means of ozone of the impure outflow of waste waters from towns and manufactories. Such water could fitly be treated by ozonization, the bacilli killed, ammonia converted into nitrate of ammonia and the organic constitutents as far as possible oxidized.

The process of ozonization can be easily understood from the accompanying sketch, which gives a general view of the apparatus used. The vessel (A) containing the water to be ozonized is provided with a perforated tube (B), arranged as a coil and constructed of a material which will withstand the action of ozone, the air space above the water being closed with a cover. The ozonized air above the water, flowing from the ozone apparatus (C) and gasometer (D) is, by means of a pump (E), which is also properly protected from the action of ozone, continually forced through the piping (B), so that the ozone passing through the coil, bubbles up through the water, throws it into violent agitation and thereby effectually ozonizes it. The pump, by suction, receives fresh ozonized air from the ozone apparatus and gasometer connected with it. The cock (F) is so arranged that only the actual amount of ozone required for ozonization passes through.

From the foregoing description it is evident that with very simple apparatus, water can be thoroughly purified and sterilized, and it is only a matter of construction of plant on a sufficiently large scale to treat any quantity of water, as with present improved methods of producing ozone, it can be manufactured in unlimited quantity, making it available for the various industries in which it could be advantageously applied.

Continued experiments in this new field of chemistry indicate that the future of ozone is a great one. It may be interesting to note that for bleaching purposes ozone has no equal; in fact, the process of lawn bleaching, the most perfect of all bleaching processes, is due to the presence of ozone in the atmosphere. The cheap production of ozone would seem to point to its future employment on a large scale in the bleaching of pulp and textile fabrics, especially where the original purity of the treated material is a matter of moment, and it is desirable to avoid the introduction of anything foreign or destructive to its substance. It would be impossible and, indeed, undesirable to take up space in the enumeration of the various industries in which ozone in the near future will play an important role. Professor Bunsen remarked many years ago: "If ozone could be produced on anything like a commercial scale, hundreds of uses could be found for it," and doubtless many industries dependent upon the oxidation or change of one or other of the constituents or materials employed in manufactures, will find use for ozone.

This comparatively new intimate connection of electrical and chemical science opens up a vista of possibilities which are of the greatest importance, considered from hygienic, medical or industrial standpoints, and although only few have been yet engaged in the prosecution of experiments in this field, the work done has been crowned with so great success that, doubtless, others will be tempted to investigate the properties of ozone, with the view of determining its value to the commercial world.

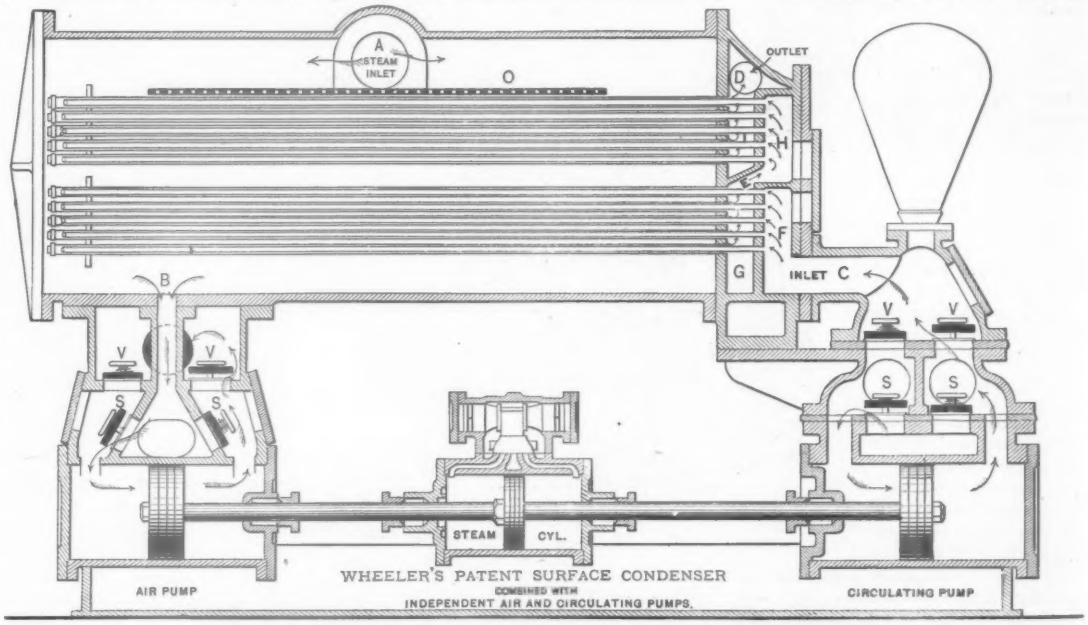


FIG. 2.—SECTIONAL ELEVATION OF WHEELER'S CONDENSER.—(SEE FIRST PAGE.)

New Cable Projects.

The new ocean cable projects brought out recently are regarded with interest by the representatives of foreign governments in Washington. The line just opened that puts the United States in direct telegraphic communication with the countries on the east coast of South America is the property of a French company, and has entered into active rivalry with the two circuitous lines by which that coast has heretofore been reached.

An important submarine cable soon to be laid is that between Pernambuco, in Brazil, and Senegal, in Africa. It is a British company that is the promoter of this project, and recent advices give assurance that, unless there be some unexpected obstruction, the line will be in operation within the next half year. When the Emperor Dom Pedro was in power in Brazil, a few years ago, he was desirous of extending the trade relations between his empire and the countries of the west coast of Africa, and it is the project in which he was interested that is to be carried out. With steamers running between Pernambuco and Senegal, and with submarine intercourse, there is reason to suppose that the trade between the African and South American continents will be increased.

The two projected cables across the Pacific for telegraphic communication between the American continent and various lands and islands of the Pacific are of interest to other governments than those of the United States and Canada. Last Spring a British naval expedition was engaged in the business of finding a bed for the cable which, running northward from Australia to Hawaii, is to have its American terminus at Vancouver, in British Columbia. This project is of importance to the British government, as it offers a line of communication between London and the British possessions in Asia by its connection with the Canadian wires and the Atlantic cable. Its value to Queen Victoria's empire, in times of emergency, cannot be over-estimated, and it will be of especial service when British troops are transported across Canada to the Pacific on their way to the East Indies. The Pacific cable will promote British interests in Asia, Australasia, America and Europe.

The American project for a Pacific Ocean cable between San Francisco and Honolulu met with some encouragement at the last session of Congress, when the sum of $25,000 was appropriated for the preliminary surveys. At the beginning of last June the Secretary of the Navy selected the steamer "Thetis" to perform this service, but she was soon sent off elsewhere, and a fortnight ago he selected the "Albatross," which will at once undertake the duty. Though Congress furnished the means for the survey, further government aid to the project was refused when the House rejected the bill that had passed the Senate, giving a subsidy to a company which desired to construct the line.

It is understood that the British surveying expedition will report the existence of a satisfactory route for the British cable in the Pacific, and there need be no doubt that the Albatross will find an available route from San Francisco to Honolulu.

ELECTRO-CULTURE.

SOME PRELIMINARY STUDIES OF THE INFLUENCE OF THE ELECTRIC ARC LIGHT UPON GREENHOUSE PLANTS.

The Cornell University agricultural experiment station has issued a bulletin giving the results of a number of experiments on the influence of the electric arc lamp upon greenhouse plants. The following is an abstract of the report:

In the Winter of 1889-90 we undertook experiments to determine what influence the ordinary street electric light exerts upon plants in greenhouses. Much has been said among gardeners concerning supposed retarding or accelerating influences of street lamps upon plants. Many have supposed that the electric light can be introduced profitably into greenhouses for the purpose of hastening growth. Still others have supposed the electric lights at exhibition halls to be injurious to plants, and have said that flowers fade quickly when placed near them. The whole subject of the relation of electric light to vegetation should be understood, and wholly aside from any thought of introducing the light into greenhouses, its influence upon plants, both under glass roofs and in the open, is a question which demands careful investigation.

For the purpose of our experiment, a forcing house 20x60 feet was set aside. The house is low, with a two-thirds span and a very flat roof (22½ degrees), and was designed for the growing of lettuce, radishes and cuttings. The house is ventilated entirely from the peak by small windows hinged at the ridge. It is heated by steam, the riser running overhead and the returns all lying under the benches. This house was divided into two nearly equal portions for our purpose by a tight board partition. One compartment was treated to ordinary

FIG. 1.—NORMAL SPINAGE PLANT NOT SUBJECTED TO ELECTRIC LIGHT.

conditions—sunlight by day and darkness by night—and the other had sunlight during the day and electric light during a part or whole of the night. In all the experiments the lamp was suspended from the peak of the house, the arc being two and one-half feet above the soil of the bench over which it was placed. The arc was nine and three-quarters feet in a direct line from the edge of the lowest bench and three and one-quarter feet from the edge of the highest bench.

During the first Winter (January to April, 1890) we used a 10 ampere, 45 volt, Brush arc lamp of 2,000 nominal candle-power. This was run all night—from dusk until daylight—from January 23 to April 12. At first the light was started at 4.30 in the afternoon and ran until 7.30 in the morning, but as the season advanced the run was shortened until, in April, it ran from seven o'clock till five. For the first six weeks the light was naked, but during the remainder of the time an ordinary white opal globe was used.

EXPERIMENTS WITH A NAKED LIGHT RUNNING ALL NIGHT.—(1890.)

The general effect of the light was to greatly hasten maturity, and the nearer the plants grew to the light the greater was the acceleration. This tendency was particularly marked in the leaf-plants—endive, spinage, cress and lettuce. The plants "ran to seed" before edible leaves were formed, and near the light the leaves were small and curled. This is well illustrated in spinage, Figs. 1 and 2. The cuts, which are made to the same scale, show Round Dutch spinage when seven weeks old. Fig. 1 shows an average plant from the dark or normal house, and Fig. 2 one from the light house within seven feet of the lamp.*

The electric light spinage matured and produced good seeds while that in the dark house was still making large and edible leaves with no indication of running to seed. An examination, under the microscope, of leaves of the plants illustrated in Figs. 1 and 2, showed that while there was apparently the same amount of starch in each, it was much more developed in the electric light specimen, the grains being larger and having more distinct markings, and giving a better color test when treated with iodine.

Some of the most marked results in this first series of experiments were obtained with radishes. The young radish plants were strongly attracted by the light, and in the morning they all leaned at an angle of from 60 to 45 degrees towards the lamp. During the day they would straighten up, only to reach for the lamp again on the succeeding night. This was repeated until the roots began to swell and the plant became stiff. As the plants grew the foliage became much curled, and the amount of this injury was in direct proportion to the nearness to the lamp. Those nearest the lamp—within three to six feet—were nearly dead at the expiration of six weeks, while those 14 feet away showed little injury to the leaves. In Table A are figures of weights and sizes of radishes in the two houses.*

The table shows that the crops obtained in the dark or normal house were about twice greater than those in the light compartment. The entire plants and the tops were almost half lighter in the light house, and the tubers were more than half lighter, while the per cent. of tubers large enough for market was as 9 in the light house to 26 in the dark house. And it should also be said that the average size of the tubers graded as marketable was less in the light house than in the other. This is well shown in Fig. 3, which represents the six best tubers of Dreer Scarlet Frame from the dark house upon the left, and the six best from the light compartment upon the right. A portion of the plantation of White Box radish in the light house was protected by the fan-shaped shadow cast by an iron post an inch and a half in diameter. In the shadow the foliage was scarcely injured, while those leaves which projected into the light were curled.

SAMPLES.	Average weight of entire plant.	Average weight of tops.	Average weight of tubers.	No. of marketable tubers.
				per ct
Light house, in full light	.11 oz.	.09 oz.	.02 oz.	
" " shadow	.35 "	.21 "	.14 "	45
Dark house	.43 "	.21 "	.22 "	75

This variety stood near the light, ranging from four to nine feet away. The contrasts between the two houses were also very great. Fig. 4 shows upon the left the six best radishes from the light and upon the right the six best from the dark house.

A chemical analysis of samples of these radishes from the light house, in both full light and shadow, and the dark house, gave the following results:

SAMPLES.	Ash.	Potash K₂O.	Chlorophyll.	Total nitrogen.	Albuminoid nitrogen.	Amide nitrogen.	Albuminoids. (Albuminoid N. x 6.25.)
	pct.	pct.	pct.	pct.	pct.	pct.	pct.
L't house, full light	3.84	0.38	6.22	1.36	1.24	.12	7.75
" " in shadow	3.76	0.24	6.12	1.38	1.20	.12	7.50
Dark house	3.26	0.25	5.02	1.34	1.01	.33	6.31

FIG. 2.—SPINAGE PLANT FROM LIGHT (ELECTRIC) HOUSE. SAME VARIETY AND AGE AS FIG. 1.

hours of electric light. Rubber tubing was conducted underneath the pots and was connected with the hole in the bottoms in such a manner that perfect ventilation was secured and yet no light admitted. Seedling radishes, which had never received sunlight, made a slender and sickly growth, assuming a faint green color, but died in three or four weeks.

The experiment was now conducted upon a larger scale, and at a time when the hours of sunlight were about equal to the hours of electric light. A tight wooden frame was placed upon the soil of a bench at one end of the light house. This frame was provided with a tight cover which was kept on during the day and removed at night. February 1, radish seeds were planted in this frame, both in the soil and in pots. The plants appeared on the 5th, and for several days grew very rapidly, making a spindling and nearly colorless growth. They were shaded by the side of the box and received only diffused light. On the 11th, some of them measured four inches to the leaves and six inches in total height. On the 12th they looked yellow and seemed to be failing. February 21 they began to die, and they were all dead on the 28th. On the 8th of February the radish seeds were sown in pots and these were elevated in the frame so that the young plants received direct light. The plants were up on the 11th. They behaved the same as those in diffused light, and all were dead March 3. None of the radish plants in the entire experiment succeeded in making a third or true leaf.

Strong lettuce plants were set in the frame in diffused light, but all died in about two weeks. Beans were planted February 3 in diffused light. The plants appeared on the 10th. On the 25th growth had ceased, and the stems were 10 to 12 inches high, slender and light colored. They were all dead March 13. The second pair of true leaves appeared, but did not develop. Corn planted at the same time had grown 12 inches tall by February 25, and was dead March 7. Potato tubers planted February 5 made a spindling growth and reached the top of the frame (somewhat over a foot) March 13. The stems then fell over because of their weakness and grew about the bottom of the frame. April 3 the stems were nearly four feet in length, very spindling, and bore a few small and pale leaves. A small and healthy castor bean plant chanced to be growing on the bench when the frame was placed in position. This was covered by the

(Continued on page 116.)

TABLE A.

VARIETY.	Average weight of entire plant.		Average weight of top.		Average weight of tubers.		No. of marketable tubers.	
	Light house.	Dark house.	Light house.	Dark house.	Light house.	Dark house.	Light house.	Dark house.
Cardinal Globe	.14 oz.	.17 oz.	.08 oz.	.08 oz.	.059 oz.	.089 oz.	55 pct.	62 pct.
Dreer Scarlet Frame	.067 "	.14 "	.036 "	.057 "	.031 "	.083 "	30 "	74 "
White Box	.23 "	.43 "	.048 "	.21 "	.082 "	.22 "	6 "	75 "
" "	.27 "	.50 "	.16 "	.23 "	.11 "	.27 "	18 "	100 "
Average	.18 oz.	.31 oz.	.081 oz.	.14 oz.	.07 oz.	.16 oz.	27 pct.	78 pct.

These figures show that the plants under the electric light had reached a greater degree of maturity than those in the normal or dark house. The ash is more, potash more than double, and chlorophyll (including extracted gums) somewhat more. The total nitrogen is essentially the same in all samples, but it is noticeable that in the electric light plants more of the amide nitrogen has been changed into other forms than in the other sample; and the electric light samples are richer in albuminoids. The light house plants from the shadow are much

*All distances from the lamp are measured in a direct air line from the arc.

*The figures were made from the entire crop when the plants in the dark house gave the first good market picking, and this accounts for the small per cent. of marketable tubers in the table; but the plants in both houses were the same age.

Pulaski, Va.—Pulaski Electric Company; capital, $25,000.

Chicago, Ill.—Chicago Electric Wire Company; capital, $1,000,000.

Bucyrus, Ohio.—The Suburban Electric Railway Company; capital, $200,000.

Lowell, Mass.—Baker Telephone Index and Tablet Company; capital, $15,000.

Pueblo, Colo.—The Citizens' Electric Light and Power Company; capital, $100,000.

Baltimore, Md.—Southern Electric Company, to manufacture electrical machinery; capital, $50,000.

Boston, Mass.—Guest Magnetic Ore Separator Company, incorporated in West Virginia; capital, $1,000,000.

Pulaski, Va.—Pulaski Light and Water Company, to build electric light plant and water-works; capital, $200,000.

Buffalo, N. Y.—Buffalo, Kenmore and Tonawanda Electric Railway Company; capital, $150,000. The road will be eight miles long.

Pueblo, Colo.—The Citizens' Electric Light and Power Company; capital, $100,000. Incorporators, J. F. Vaile, J. H. Block and J. W. Finlair.

Baltimore, Md.—Baltimore Gas Fixture and Art Metal Manufacturing Company, to manufacture gas and electrical fixtures; capital, $6,000.

Jersey City, N. J.—The American Engineering Company, to construct steam and electric power stations and plants, etc.; capital, $1,000,000.

Leslie, Mich.—A stock company known as the Leslie Electric Light and Power Company will be organized at once, with a capital of $10,000, for the purpose of lighting the village.

Chicago, Ill.—Chicago and Central American Company, to export and deal in railroad, telegraph and telephone supplies; capital, $5,000,000; incorporators, R. L. Martin, David A. Courter and Horace F. White.

Minneapolis, Minn.—Bates Electric Conduit Company, C. H. Bates, President; to manufacture, own, use and sell conduits for carrying or holding wires underground for electric or other purposes; capital, $1,000,000. The rights for New York city have been sold.

Chicago, Ill.—The United States Corporation Bureau reports 243 newly completed corporations in the United States for the week ending October 2, 1891. The total capitalization was $61,375,875. The number of light, heat, power and transportation companies was 22, with $9,325,000 capital.

New York, N. Y.—The Wheeler Condenser and Engineering Company has recently filed articles of incorporation at Trenton, N. J. The company has bought out the entire plant and business of the Colwell Iron Works, at Carteret, N. J., which is one of the largest concerns in this country manufacturing vacuum pans and special machinery for sugar refineries, salt works, condensed milk factories, etc. The Wheeler company will continue to manufacture Wheeler's patent surface condensers and other of his specialties. The capital stock of the company is $300,000, and the incorporators are as follows: Frederick Meriam Wheeler, of Montclair, N. J.; Aaron Vanderbilt, of New York city; Clifton H. Wheeler, of Brooklyn, N. Y.; William H. Hampton, of New York city, and Charles W. Wheeler, of Brooklyn, N. Y. The headquarters of the company will be at 92-94 Liberty street, New York city.

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It has been remarked that the very men who threw cold water on electric railway schemes when first projected, are now howling because they can't get enough electric road bonds and stocks.

Uncle Jerry's rain-makers have not been as successful as the Eiffel Tower in producing rain. It is said that the great tower attracts so much atmospheric electricity as to cause great cloudiness and increased rainfall in the vicinity of Paris.

The article of Prof. Van der Weyde and accompanying illustrations will prove of historical interest. The experiments so graphically depicted were of a character to amuse rather than instruct. Industrial uses of the mysterious agent were not then dreamed of. Inventive resources were not lacking, however, for the ingenuity expended on insulating the gilt-edged gentleman in silk stirrups (Plate B) commands even modern admiration, though we can scarcely say as much for the method employed on the contemporary who holds his hand.

It has been set forth in the daily press that Mr. Edison has discovered a method of electric traction that dispenses with trolley wires and all direct connection between the electric motor and the generator. One year ago, in reply to a query from the Editor of the ELECTRICAL REVIEW, Mr. Edison stated he was engaged at that time in trying to discover a way to pick up the electric current through two inches of mud and he had found it quite an interesting puzzle.

To-day it would seem that the inventor is of the opinion that he has solved it, and further information from him will be eagerly looked for. Mr. Edison, however, informs the REVIEW that he "does not want the particulars published just yet, but prefers to wait until his plan is in actual commercial use."

We publish in this issue an interesting and timely article by Mr. J. C. Dittrich, in which he describes some experiments on the purification of water by ozone. These experiments are interesting as tending to show that water may be freed from bacteria and certain forms of inorganic matter by the use of ozone, and as ozone is made by an electric agency, the question becomes of interest to electricians. It seems that the method proposed by Mr. Dittrich has sufficient merit to warrant its trial on a large scale by our municipal authorities, with a view of determining its cost and efficiency of practical operation. The discussion of this question brings to mind the fact that the city of Bridgeport has but a three weeks' supply of water, and unless there is a speedy and copious rainfall, serious results may follow. Now, if electricity can be successfully applied to the purification of fresh water, why cannot it in some way be used to precipitate or otherwise dispose of the foreign matter which renders sea water unfit for drinking and manufacturing purposes? Here is food for the thoughtful electrician. He who makes the water of Long Island Sound available for the Bridgeport manufacturer will have fame and fortune second only to the genius who will produce electricity direct from coal.

NOVEL USES OF ARC LIGHTS.

Arc lights have served many uses outside of conventional methods of illumination, not merely in connection with the good work of attracting and then singeing quarts of small bugs with big names, but their actual application has been at times quite out of the usual course of events.

An arc light is not usually regarded as an equivalent for a rifle, although one recently served such a purpose without causing any injury to life. Two steamers were racing on Long Island Sound, and when in a somewhat difficult channel the captain of the slower steamer bethought himself of the search-light, which was trained on the pilot house of the rival, causing such a dazzling of eyes that careful navigation was out of question; and although green spectacles and irreverently accentuated speech were fairly tried, it became necessary to diminish speed and let the other boat pass.

The electric light doubtless saved life (and also the race); because, following the custom of the good old times under such circumstances, the captain would probably have adopted the Western river custom of taking a rifle, going well forward among the freight, and picking off the pilot before submitting to defeat; or, if unduly merciful, he might have contented himself with merely passing the bullets into the pilot house in such a way as to chip off the woodwork around the pilot by way of vigorous hint.

Electric lighting has been applied at races equitably to the interests of all parties in horse trots at night, where the races were all right, but the people did not conform to the unusual change in hours.

The actinic rays in arc lights render them very useful in methods of photography other than those of portraiture. In the numerous applications of photography, in copying and engraving, uniform effects can always be obtained and the work constantly carried on at will independent of the sun—comfortably taking the weather as it comes, whether one has a Farmer's Almanac or no.

It is not generally considered that light is necessary to find a fire; but an arc light is to be credited with such work in revealing a fire in the upper part of the Public Building in Philadelphia, in the Summer of 1883, when an arc light hanging over the courtyard, illumined the smoke curling from the fire before any flames were visible to those on the ground.

In the same city, arc lights served a very useful purpose in guiding the firemen around the lower part of a building which was burning above. The globes were of the cup shape, and readily catching the water from the streams leaking through the building, presented the strange aspect of light burning under water.

I do not recall any instance of the use of arc lights in surgery, although an attempt was faithfully made in this direction at the time of the assassination of President Garfield. The circumstances related to me by one of those engaged in the preliminary (and final) experiments were as follows:

The surgeons were very much embarrassed by their failure to determine the position of the bullet in the body of the President, and some one considered that if a powerful beam of light could be concentrated upon his person it would render the bullet visible. Several naval officers at the Washington Navy Yard gave the inventor the assistance of all the resources of the yard, and in a very short time a 10-light arc lighting dynamo had been installed with only one light in circuit, and which was regulated by hand. This light was in the focus of a mirror which would concentrate the rays at a point about 10 feet distant.

The illumination upon an iron plate held at this point was very brilliant, but in order that the experiment could be submitted in all its fullness to the surgeons in attendance upon the distinguished patient, it was determined to make a preliminary trial upon an army veteran who carried a bullet in the lower part of his back near to the suspected location of the bullet in the body of the President.

The man disrobed to the practical extent necessary for making the trial, and, standing upon the spot marked for the focus, the large arc light was lighted and the mirror swung into position. At this point the subject gave a leap further into space than any wager could have tempted him, and driven into incoherency endeavored to express his surprise at the abuse to which he had been subjected by searing his back without notice. In fact, nothing but hobbled feet from neglected pantaloons prevented him from endeavoring to make summary reprisals upon the experimenters, who in turn were equally surprised, as their work had been based upon the assumption that there was no heat in the illumination radiating from arc lights.

Suffice it to say that the proposed method of treatment was never brought to the attention of the surgeons, as at first contemplated.

Numerous experiments have been tried with a fair degree of success in hastening the growth of fruits by the use of electric lights; but transportation from farther South is a very good means of obtaining early fruits. In certain agricultural districts given to the cultivation of small fruits, the arc lights in villages and towns are used without globes in order to encourage suicide among insect pests.

About 10 years ago I lectured at Lowell before the Association of the operatives on "Uses of Electricity." This lecture was illustrated by numerous electrical experiments, all of which were definitely realistic, the lights being very bright and the explosions very loud.

The electricity for these experiments was obtained from a lot of the Faure storage batteries, which had been brought to this country on the steamer "Labrador" a few weeks before, and in themselves constituted a matter of noteworthy interest, being, I believe, the first public exhibition of storage batteries in this country.

In the course of some of the preliminaries for the evening performance, an assistant connected a Weston arc lamp directly to the poles from the storage batteries, and the regulating apparatus was burned out at once; but fortunately we had another lamp, and this was connected in shunt by placing two wires from each of the conductors in an earthen wash basin filled with water, having the conductors nearly in contact at first and removing them until enough electricity would pass through the lamp so that it would regulate satisfactorily. Then the wires were tied in that position, and in the course of the lecture in the evening, the current was switched onto this arc light with very satisfactory results.

C. J. H. WOODBURY.

CORRESPONDENCE.

OUR BOSTON LETTER.

Electric lights will soon be in use on the streets of Saugus, Mass., the selectmen of that town, at a recent meeting, having granted permission to Messrs. Kimball & Halvorson to furnish electricity for both light and power.

Charles B. Dinsmore, superintendent of the Marblehead Gas and Electric Company, died October 4, at Marblehead, Mass., aged 29 years. He had resigned his position as superintendent of the gas works, to take effect October 15.

Electric Railway for Woburn, Mass.—The directors of the East Middlesex Street Railroad Company have petitioned the aldermen of Woburn, Mass., asking permission to erect poles and string wires on Main street, city named, and to use the overhead trolley system.

The Cumberland Manufacturing Company, Westbrook, Me., has decided to have an electric tramway in operation between its works and the coal wharf, a distance of 4,000 feet. The cars will be hauled by an electric locomotive equipped with a Thomson-Houston motor.

The Eastern Electrical Supply and Construction Company, of this city, report that it will have an extensive and varied line of street railway supplies on exhibition at the Pittsburgh Convention. Among these supplies will be found several specialties for which the company are sole agents. President Maybin W. Brown will be present at the Convention and look after his company's exhibit.

The Walworth Manufacturing Company, of this city, the well-known makers of the popular "Walworth" electric railway pole, will have on exhibit at the Street Railway Convention, Pittsburgh, Pa., a varied line of poles, plain and ornamental. Colonel L. R. Greene, manager of the Walworth Company's pole department, will attend the Convention and have charge of the company's exhibit.

The West End Railway Company has in contemplation the introduction of double-decked cars on its various electric lines in May next, and it is generally believed that such cars will materially increase the travel on the suburban routes of the road and otherwise prove a success. It is said that when Mr. Whitney visits Chicago he will inspect a new double-decked street car which the Pullman Company has built.

The Robinson Electric Truck and Supply Company, of this city, will have on exhibition during the Street Railway Convention, one of its largest radial truck cars. This car is equipped with two 25 horse-power (Thomson-Houston) new "W. P." motors, and is furnished in magnificent style. It will be run continually each day during the Convention for the exclusive use of the members and their friends. President Robinson will be on hand.

The "Ætna" Arc Lamp Insulator is another novel and useful invention of Messrs. Albert and J. M. Anderson, of Boston, Mass. Its merits will be generally known and appreciated among electric light people within a short time, and then the demand will largely exceed the supply. This insulator will prevent running your current into the ground and neutralizes danger and a possibility of accident to the trimmer or any one handling an arc lamp on a line circuit.

President H. W. Whitney, of the West End Railway, has started on a Western trip and will be absent from Boston about a month. His trip will be principally in the interests of the magnificent and ably-managed railway system of which he is the president and leading spirit. He intends to visit Chicago, Minneapolis, St. Paul and several other Western cities and towns and will inspect the respective electric railway systems of each before his return to the "Hub."

Messrs. Albert & J. M. Anderson, also of this city, the well-known manufacturers of the "Boston Trolley" and other specialties, will make a creditable and interesting display of their products at the electrical exhibition to be given during the Convention next week at Pittsburgh. The Messrs. Anderson are enjoying a large trade with electric street railways, especially with their bell insulators made from a new insulating material known as "Ætna." Among the large orders were those received recently from the Buffalo, N. Y., Street Railway Company and Brooklyn, N. Y., Street Railway Company. W. I. B.

Boston, October 10.

OUR PHILADELPHIA LETTER.

Carl Lauber contemplates putting a storage battery plant in his new building, now being erected at Ninth and Cherry streets, Philadelphia.

Queen & Company this week purchased two 400 light Mather dynamos for their new building, Tenth and Chestnut streets, this city. Messrs. M. R. Muckle, Jr. & Company are consulting engineers for this plant.

The Fort Wayne Electric Company, through Mr. G. A. Wilbur, manager Philadelphia branch, this week closed a contract for a 150 arc light apparatus for Millville, N. J. Messrs. Clay, Pepper & Register, electrical engineers of this city, are doing the construction.

The Thomson-Houston Electric Company's Philadelphia office reports business exceedingly good. Among the recent plants sold is a 600 light incandescent plant to Shaw, Esrey & Company, Chester, Pa. Mr. John Frigar, superintendent of the Clifton Electric Light Company, and electrician of the Drexel building, this city, was consulting engineer for this plant.

Mr. C. A. Bragg, agent Westinghouse Electric and Manufacturing Company, reports the following recent sales: Boothby & Kugler, 800 lights, two 400 light United States dynamos; Aldine Hotel, one 200 and one 600 light United States dynamos; G. & H. Barnett, one 300 light United States dynamo; Onderdonk Heating and Ventilating Company, 50 lights, United States; all of Philadelphia, Pa.; one 60 light Westinghouse alternating current arc dynamo to the Maryland Steel Company, Sparrows Point, Maryland; one 1,500 light Westinghouse alternating current incandescent dynamo to the Citizens' Illuminating Company, Pittston, Pa.; one 750 light Westinghouse alternating current incandescent dynamo to the Faraday Heat, Power and Light Company, Morton, Pa.; one 1,500 light Westinghouse alternating current incandescent dynamo to the Southern Electric Light and Power Company, Philadelphia.

Philadelphia, October 8. N. J. M.

OUR ALBANY LETTER.

The Albany Railway has declared a quarterly dividend of 1½ per cent., payable November 1.

At Albany the Buffalo, Kenmore and Tonawanda Electric Railway Company was recently incorporated, with $150,000 to construct an eight-mile road.

An ingenious new motor car contrivance is being tested at Cohoes, N. Y. It is called an automatic supporter. There are in use in the present motor cars two bars extending along the roof, to which are attached straps, and passengers who are obliged to stand take hold of them to steady themselves. These straps are unanimously pronounced a nuisance, as they swing with the movements of the car and strike passengers in the face. The new device does away with these poles and straps. It is a nickel plated cylinder, about 2⅛ inches in length, which contains a spring, to this is attached a strap at the end of which is a small nickel plated piece of iron that can be taken between the fingers. When it is taken hold of, the spring allows it to come down about 10 inches and it furnishes an excellent support. When released the strap recedes into the cylinder and cannot interfere with passengers. The patentee is a Cohoes man.

All of the franchises of the Capitol Railroad, Albany, N. Y., for side lines have been leased to the Albany Railway (electric) by the trustees of the former road. For a consideration to be named later, it was decided to lease. The franchises include a line of road to run from the Central Depot up Steuben street to Eagle street, to the Washington avenue tracks of the Albany Railway; a line from the corner of Plain and Grand streets, along Grand and up Hamilton to the present line of the Albany Railway; a line from the corner of Lexington avenue and Clinton avenue, up Clinton avenue to Quail street and over Quail street to Central avenue, there to connect with the Albany Railway; and, finally, a line from Hamilton street to Madison avenue on Lark street. It is understood that the Albany Railway will soon build both the Steuben and Clinton avenue lines. The work of extending the tracks on Grand street, from Hamilton to Plain, has been begun.

Albany, October 10. L. W. W.

OUR CHICAGO LETTER.

Mr. W. A. Sheldon, of the Schuyler Electric Company, spent a day or two in Chicago last week.

Mr. Hugh H. Harrison, of the Lieb Machine Works, New York, was a caller at the REVIEW office this week.

Mr. M. E. Baird, the genial representative of the Eddy Electric Manufacturing Company, was a recent Chicago visitor.

Mr. Chas. E. Lee, manager of the Chicago branch of the Electric Gas Lighting Company, reports a very flattering trade since opening this branch.

The Patton Motor Manufacturing Company will be represented at the Pittsburgh Convention by Mr. Thos. Saunders, general manager of the company, and Mr. W. H. Patton, the inventor of the new system of street car propulsion. L. W. C.

Chicago, October 10.

Value of Expert Service.

H. Ward Leonard & Company, electrical engineers, New York, will shortly issue a pamphlet entitled, "The Value of the Services of a Consulting Electrical Engineer to Persons Investing in Electrical Plants."

As instancing the value of competent advice, they will cite the following cases which have come before their personal attention:

The architect of a magnificent fire proof building dealt with a company which had installed in two exactly similar buildings plants which were perfectly satisfactory in every respect.

The same engineer had supervision of the work for the electrical company that had had charge in the other instances, and he laid out and carried on the work until it was more than half completed. The engineer mentioned then left to accept a position elsewhere and the work passed into the hands of another engineer, not so experienced in this particular line and whose time was fully occupied with the most important duties. The fact that the architectural material in which the conductors were being placed was of such a character as to certainly destroy the insulation escaped notice, although had it been appreciated either the material or the insulation might have been altered with perfect results and without additional expense, as the material was strongly impregnated with a free alkali entirely unnecessary, and even had it been necessary an insulation might have been found which would withstand the alkaline action perfectly.

The lack of a competent supervising engineer in this case made it necessary to remove the wires after the building was completed, at an expense of some $8,000 in actual direct expenditure of money, and the annoyance, delay and imperfect result probably represented an equivalent sum.

Another instance of an entirely different nature was that in which an architect followed the advice of a manufacturer of insulated wires. The wire manufacturer was bent on insuring that the plant should be A1 in every way, and not being thoroughly familiar with the calculation of complex electrical distributions, followed the usual method in such instances and made the wires "big enough." What possible inducement could there be for him to reduce the amount of his wire to be used when in so doing he was certainly reducing his profits and also increasing the possibility of an imperfect distribution?

The plant gave a perfect result, but it cost $6,000 more than would have been necessary to accomplish exactly the same result, as far as the purchaser was concerned.

Had a competent supervising engineer been retained and the wire manufacturer relieved of the responsibility of the distribution, the wire manufacturer would have been pleased to see the saving effected for his friend, as it was the fear of a less perfect result and not the consideration of an increased personal profit which determined his action.

As all the competing companies bid under the same specifications, they had no interest in attempting to convince the purchaser of the error of his friend, which proved so expensive for him.

A certain concern established a plant to transmit power. The initial power being water-power and abundant, they informed the company with whom they were dealing that the power, being very cheap, they did not care how much they wasted so long as a certain amount was received at the other end. Not fully appreciating the laws governing the conditions of maximum economy for such a plant, but being aware that the greater the loss in the conductors the cheaper would be the cost of the conductors, the electrical company decided to waste 50 per cent. in the conductor. The plant was so installed and is, no doubt, operating satisfactorily, and, perhaps both the electrical company and the purchaser are still in ignorance of the fact that exactly the same power might have been transmitted with a saving of 20 per cent. of the cost of the plant, under the same electrical pressure, and that under no circumstances whatever would it be economical to transmit power with a loss of 50 per cent. in the conductor.

West End Street Railway Company.

Some representative Boston capitalists have just returned from St. Paul where, with officials of the West End Street Railway Company, they have been looking over the electric plant of the St. Paul and Minneapolis street railways. They were very much gratified at the demonstration furnished by this most perfectly equipped electric street railroad plant in the world, and in the *Boston News Bureau*, one of State street's most clear-headed financiers says:

"There is no doubt about it, neither horse nor steam can compete with an electric road. All local steam trains between St. Paul and Minneapolis have been taken off, while the electric road between the cities runs trips every eight minutes and must, it is expected, soon increase the number of trips to a five-minute basis. No street railway can live as against an electric road. There is no question about the saving. Electricity is the cheapest mode of propulsion for compact traffic yet discovered and the demonstration is complete. The street railways of St. Paul and Minneapolis, operated under one management, have two of the most complete electric plants in the world, with everything of the latest pattern and most modern improvement, even to the fuel; for no coal is used, but oil is burned instead. They have two great power plants perfectly equipped and large car houses, one of them with a capacity for 200 cars.

"The company can afford to put in the best plant, for its franchises are perpetual, the cities are growing rapidly and the people appear perfectly satisfied with the system; while for the stockholders the earnings are increasing every week and dividends are looked for by the management in the not remote future. The increase of travel has justified all that has been said regarding the development of business from quickened communication. The gross earnings have doubled and trebled. It is no longer an expectation; it is an accomplished fact. The companies have secured all the capital they needed by pledging their bonds at 75 behind three-year notes, and Mr. Lowrey declines to sell the bonds upon the present basis for the bond market, as the company is in easy financial circumstances and has three years in which to market its bonds. It has been a most marvelous transformation—this union of two great street railway companies, and connection, by electricity, of the traffic of the two cities, and the disappearance of every horse car, and the West End people were extraordinarily impressed with what has been accomplished there and with the earning results now being shown."

American Institute of Electrical Engineers.

To the Editor of ELECTRICAL REVIEW:

The monthly meeting of the American Institute of Electrical Engineers has been postponed until October 27, to avoid conflicting dates with the Street Railway Convention at Pittsburgh.

Yours very truly,

RALPH W. POPE, Secretary.

New York, October 10, 1891.

Another World's Fair Building Condemned.

One more building of the World's Fair, at Chicago, has been condemned by the architects as being unsafe. This is the building for the electrical display.

While the engineers have not finished their work, they have gone far enough to show that $75,000 must be spent in strengthening the building in order to make it absolutely safe.

The electrical building was the last of the great buildings to be overhauled by Chief Burnham.

Mr. Morrison's Alternating Sequel.

It will be remembered that a short time ago Mr. W. J. Morrison, agent of the Fort Wayne Electric Company, for New York State and Canada, assumed the responsibilities of an author and produced a work entitled "Kind Words." The implied burden of the song was the merits of the Wood arc light system. We have just received advance proofs of Mr. Morrison's second venture. It is an alternating sequel to "Kind Words" in which the Slattery induction system of incandescent lighting is discussed in 70 letters received from men who are using that system every day. The encomiums of praise are very high.

Telephonic News

*** The telephone line has been completed to Wedowee, Ala.

*** South Superior, Wis., will shortly have a telephone exchange.

*** The Lemars, Ia., Telephone Company will rebuild its whole plant next year.

*** The laying of cables in the new underground conduits of the telephone company at Bridgeport, Conn., was commenced last week.

*** The Inland Telephone and Telegraph Company have commenced the extension of their telephone line from Moscow to Genesee, Idaho.

*** The telephone company at Newport, R. I., is contemplating resuming the work of reconstruction of its lines, which it left off last Spring.

*** Work is progressing rapidly on the new telephone line being constructed between Appleton and Milwaukee. The poles have all been set and the wires strung as far as Oshkosh.

*** The telephone system at Racine, Wis., was crippled October 5, and 350 telephones were rendered useless, by the falling of an electric light wire upon the telephone wires, the current burning off every wire in the central office.

*** The Bell Telephone Company at Toronto, Ont., has placed in City Solicitor Biggar's hands the agreement with the city, as approved by the council, duly executed. The instrument went into force October 1. The prices of telephones for private houses are reduced to $25 per year and $45 for business houses.

*** The suits of the United States of America *vs.* The American Bell Telephone Company and Alexander Graham Bell to try the question as to whether the patents of the latter were obtained from the Patent Office at Washington by frand, are now before Mr. Henry L. Hallett, at Boston. He is an examiner in the case and is taking testimony.

Antiquity of the Telephone.

English travelers and officers in India who have managed, through favoritism with the priests, to gain access to some of the half ruined temples of Panj, a city about 200 miles from Madras, have learned that the principles of the telephone have been known in that country for thousands of years. In the city of Panj there are two temples, about a mile apart. In the interior, on the ground floor of each, there is a small circular room guarded day and night from natives as well as strangers. These rooms are supposed to be the abiding places of "governing spirits," but in reality are the termini of a telephone line which is laid underground from one building to the other.

The superstitious natives regard these little circular rooms with the greatest awe, because they have had demonstrated to them on various occasions the power of these "governing spirits" to communicate with the other temple. When this miracle is being performed the natives are required to make their offerings in one building and make known their wishes and desires. Then, upon immediately repairing to the other temple, they are informed of all they have said and done. To us that is all easy enough, but to the superstitious native of India it is proof that the priests are supernatural beings.

Those who have visited these telephone-connected temples say that the transmitters are of wood, and that they are about the size of the head of a flour barrel. The wire is said to be of neither steel, copper nor brass, but of a substance closely resembling the latter metal. Old worm-eaten transmitters, said to be 2,000 years old, have been shown those fortunate enough to gain admission to these temples.

ELECTRICITY 150 YEARS AGO.

A BACKWARD GLANCE AT EARLY EXPERIMENTS—BY DR. P. H. VAN DER WEYDE.

There can be no doubt but that the first knowledge mankind obtained of that which we call electricity was the natural phenomenon of thunder and lightning. But thousands of years elapsed before man had progressed far enough to conceive the possibility of producing similar phenomena on a small scale at his will.

The first step in this direction was, according to the very scant old literature on that subject, made by Thales of Milete who lived 500 years before the beginning of our era, and of which Diogenes Laertius (see his Vita Thaletus, lib. 1 segm. 21) mentions his discovery that when amber is rubbed it will attain the power of attracting light bodies. This is what most all text-books on electricity say, while they add that the name of electricity is derived therefrom, as amber is called in Greek *elektron*. For this reason we do not find the word "electricity" in the old books on this subject published in Northern Europe, but they give it a name equivalent to Burnstone power (Bernsteinkraft.) As amber is combustible it is there called Burnstone, and 150 years ago the authors of those countries were very reluctant to introduce Latin and Greek words in the German, Danish, Swedish and Hollandish, as was customary in Southern Europe, Italy, France and Spain.

Our text-books do not state the interesting fact that Thales of Milete was the founder of the Ionic School of Philosophy, and as such attempted to give an explanation of the phenomenon discovered by him. This explanation was based on the idea prevailing in his time that the soul gives to man and animals the power to produce motion, while inanimate bodies have not this power because they have no souls. He concludes, hence, that amber must have a soul, and that there may be many other inanimate bodies which have similar powers, and thus have souls. This is an idea akin to that of some of the most advanced philosophers of the present day, who hold that all matter is conscious. In this consciousness they find the key to the fact that all matter obeys the laws of nature. Plato (see his Thimaco, p. 547) and Theophrastus Eresius speak also of this power, while the latter, 300 years before our era, adds that also lycerium, which is what we call tourmaline, has the same property when heated. Further, the amber power is mentioned by Plutarchus 10 years before our era, and by Plinius in the year 50.

These details are given intentionally in order to emphasize the singular fact that when the fundamental experiments upon which frictional electricity and thermo electricity are based were known and written about, nobody took the pains to investigate further, and that more than 13 centuries elapsed after Thales' first discovery, before a man was found who considered it worth while to further investigate these peculiar properties discovered 13 centuries before his time. This man ought to be honored as giving impetus to further discoveries by publishing the results of his investigations, which were numerous. His name was William Gilbert, of Colchester, England, a practical physician in London, who lived there in the twelfth century. He found that there were more substances than amber which had the same properties. They were several gems, glass, sulphur, sealing wax, rosin, etc. He kept a record of the remarkable phenomena which he observed.

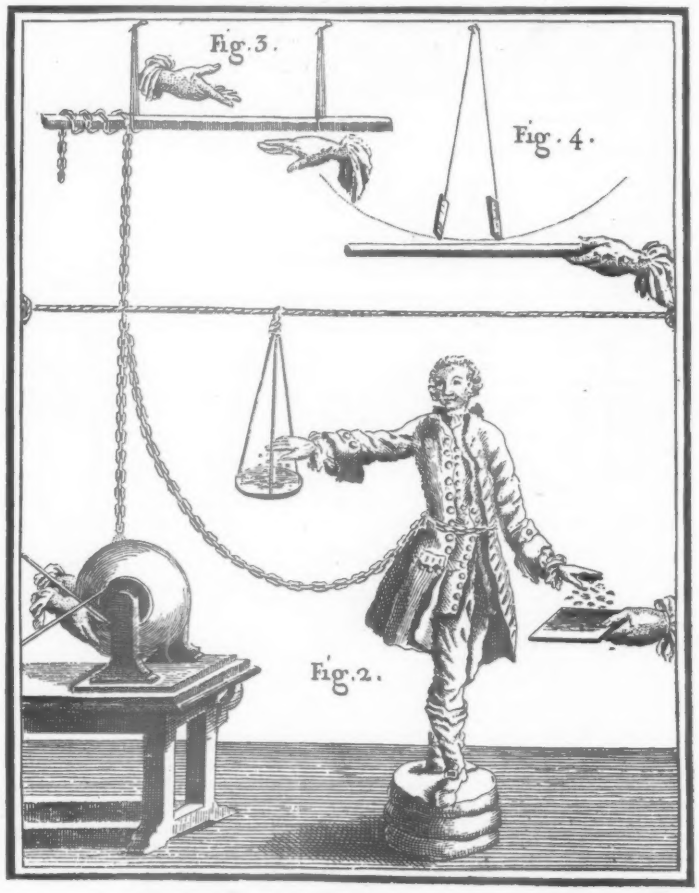


PLATE A.—REPRODUCTION OF COPPER-PLATE ENGRAVING FROM NOLLET'S SUR L'ELECTRICITE, PARIS, 1753.

After him more than 400 years elapsed before his labor bore fruit. It appears that learned men of that period had not yet been able to abandon the old rut of giving most of their attention to literary productions and the study of Latin and Greek authors. Those people, while acknowedging their merits in the progress of civilization, especially in regard to art, were miserably deficient in their powers of observation of nature's phenomena and especially in the capacity to reach correct and decisive conclusions in regard to them.

The course of instruction and the subjects taught in high schools and universities in the time of Gilbert, and until the end of the seventeenth century, being almost exclusively literary, absorbed the attention entirely, while the antiquity of the writings studied were considered as a criterion of their value in regard to reliability. But the great discoveries of Huygens in Holland and Newton in England, drew the attention of the *savants* of that period from their literary infatuations to the contemplation of nature's phenomena and laws; it performed a kind of mental revolution in the minds of the learned professions, which was so far-reaching that it is still continuing, as is seen in the fact that the most conservative universities are adding to their literary training schools for science and even for practical preparation for professions, based on the study of physics, chemistry, electricity, etc.

The discoveries of the two great men mentioned kept the general attention of the scientific world so spellbound, that the electric experiments of Gilbert were almost forgotten, while the contemporaneous discoveries of Otto von Guericke, Boyle and, especially Hawkesbee, were not given that attention they deserved. This went on until in 1728–1735, when the great electric discoveries of Etienne Gray, in England, commenced an era of electrical progress which has continued to the present day with a constantly increasing vigor.

The experiments of Gray were tested and further continued in France by DuFay, in 1738 and 1739. He discovered the difference between the two kinds of electricity, that produced by the rubbing of glass and that produced by the rubbing of rosin, sulphur or sealing wax, which were, respectively, called vitreous and resinous electricity; also positive and negative by those who adopted the theory that the first was an excess and the second a deficiency in the normal electric conditions of bodies.

Desaguliers, who made his investigations in 1739-1742, found that bodies could be divided into two classes, conductors and insulators. That the latter generally were found to be more adapted to become electric by friction was for the reason that in conducting substances the electricity is rapidly diffused and lost. A metallic tube can also become electric by friction, provided it is attached to insulating supports, such as glass. But the readiest way is to use a tube of glass well dried on the inside, or better, a solid glass rod. This is a most convenient object to develop electricity by rubbing it with a dry hand. Such a tube is represented in Fig. 4, plate A. This plate is a reproduction by photo-engraving of a copper-plate print from the "Discourses sur l'Electricité par l'Abbé Nollet," published at Paris in 1753. The figure shows how two thin strips of metal suspended by silk threads will repel one another when they become equally charged by the electricity developed in the tube by rubbing with the dry hand.

At a comparatively early period several investigators appear to have simultaneously invented the use of a globe of glass revolved rapidly, as is done with a turning lathe, while the dry hand is pressed against the revolving globe. This is represented in Fig. 2 of the same plate, where it is also seen how a person can be charged with electricity by placing him on an insulating support, for which originally a large cake of rosin was used; usually the melted rosin was poured in a small tub and when solidified a person has only to stand on it to be insulated and be charged with electricity as represented in M, Plate B, which has been reproduced from the "Experimental Philosophy" by Joan Theoph. Desaguliers, first published in London, in three very large quarto volumes, translated into Hollandish and published in Amsterdam, 1746. It is very curious to read in these books at the present day that Stephen Gray and DuFay have experimented and published their results but that "none have done this as completely as the able and conscientious philosopher Petrus von Musschenbroek, professor of natural philosophy and mathematics in Leyden, who, *in his principles of natural philosophy, has devoted a whole chapter to electricity*"!

To charge a person with electricity as represented in Plates A and B, is called "to take a dry electric bath." Such a person will then manifest all the symptoms obtained by the rubbing of amber; light bodies will be attracted by his hands as represented in Fig. 2, Plate A, and M N, Plate B.

Plate B represents also the gymnastic feat of using the human body X as a prime conductor, by suspending it by silk cords L K and letting it receive the electric charge from the glass globe by the heels of his shoes. This plate also represents the mechanism, A, B, C, D, used in olden times for revolving the globe rapidly, the hand of a person resting on it at H.

Plate C is a photogravure reproduction of an engraving from an excellent work of Jacquet published in Paris contemporaneously with the invention of the lightning rod by Benjamin Franklin, to whom he gives the so well-deserved praise. The work was translated into the Dutch language by Cor-

neles R. T. Krayenhoff and published in Utrecht, 1783. The translator was then a highly respected physician, while later he rose to great distinction.*

This plate gives, in Figs. 1 and 4, another illustration of the method of revolving the glass globes. Fig. 1 shows the repulsion of two suspended cork balls, while Figs. 3 and 4 show the mutual repulsion of water particles when poured as a jet from a vessel charged with electricity. Fig. 3 shows also the mutual repulsion of the hairs of the boy who stands on an insulating support, which is not shown in Plates A and B, because the persons represented there had, according to the fashion 100 years ago. their hair dressed in wig style or had it cut short and wore wigs for the sake of convenience to the hairdressers, who then had a more prosperous time than nowadays. The man who turns the crank in Fig. 1, Plate C, appears to have his queue charged, as it is repelled from his back, but as he cannot well be in a charged condition, it is likely that the queue is flying up and down from his efforts with the crank.

Fig. 2, Plate C, represents the first glass disk electric machine, in which the glass globe is superseded by a round disk of plate glass; it was invented in Germany by D'Ingenhouse, and revolutionized the construction of electric machines. Soon afterward a very large and improved electric machine of this kind was made in Haarlem, with two revolving glass disks of four feet in diameter, which, for many years was the greatest electric machine in existence, with which a number of experiments were performed and the results published, which added considerable to the progress of the electric science at that period.

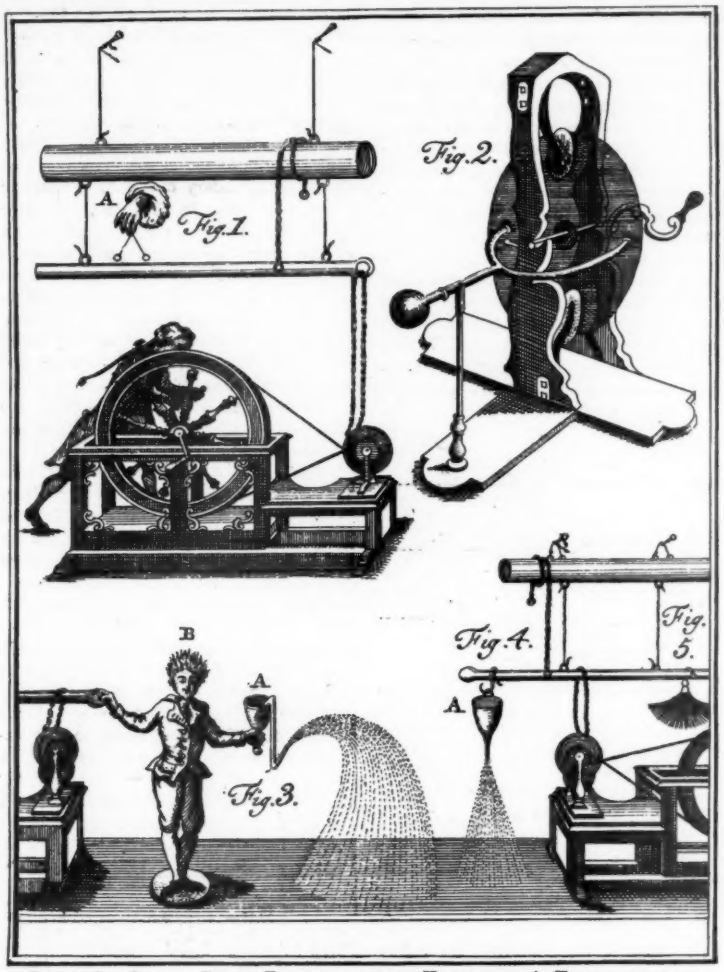


PLATE C.—COPPER PLATE ENGRAVING FROM KRAYENHOFF'S TRANSLATION OF JACQUET'S THEORIE DE L' ELECTRICITE, PARIS, 1780.

The W. S. Hill Electric Company.

The W. S. Hill Electric Company, Boston, has purchased from Mr. W. S. Hill all of his electrical inventions for electric motors, dynamos, lamps, switches, etc., and will at once enter largely into manufacturing electrical apparatus and devices.

The new men coming into the company are Geo. A. Denham, 53 Devonshire street, of the Merchants' Bank, of Sioux Falls; Geo. H. Poor, formerly general superintendent of the American Brake Company, at St. Louis, and lately of the Boyer Railway Speed Recorder Company, at Chicago; Geo. F. Gould, counsellor-at-law and judge of the Municipal Court, of Portland, Me., and Louis F. Busiel, retired hosiery manufacturer, of Laconia, N. H.

These, with Mr. Hill and his son Louis E. Hill, will constitute the board of directors. Of these, Mr. Denham will be treasurer, Mr. Poor general manager, W. S. Hill is president of the company, and his son, Louis E. Hill, will attend to the manufacturing department.

The office of the company will, for the present, be located at 54 Devonshire street. Mr. Hill's present factory at 133 Oliver street will be enlarged by taking additional floor room in the same building and the company will enter at once into the manufacturing of small dynamos, for which Mr. Hill has acquired an extended reputation.

Hill's double pole switches, station switches, arc lamp and switchboard apparatus, with various other electrical apparatus, will constitute a line of electrical goods that will enable the new company to do an extensive and profitable business.

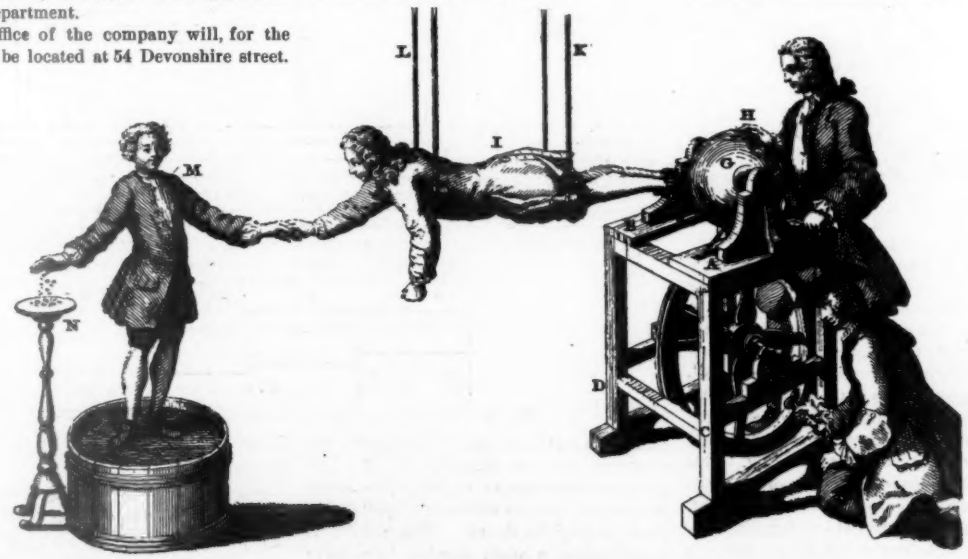


PLATE B.—COPPER PLATE ENGRAVING FROM DESAGULIER'S EXPERIMENTAL PHILOSOPHY, LONDON, 1740.

* Dr. Krayenhoff by his superior talent in mathematics as applied to hydraulic and military engineering, rose later to the most eminent positions in Holland. He rose in the army to the position of Lieutenant-General, was head inspector of military fortifications and hydraulic works, both so much needed in Holland for protection against foreign invasion and home invasion by water. He was also for a time minister of war. I have known him as an octogenarian, and as a friend of my father. I heard them when I was a boy of 10, discussing the discoveries of Oersted. He was the man who started me in the study of physics, especially electricity in which he had made several discoveries, which however he never published, as his other occupations absorbed him entirely. In the course of this history of electricity some of these unpublished discoveries will be mentioned.

PERSONAL.

Mr. J. N. James, electrician to the Naval Observatory at Washington, was a recent Boston visitor.

Senator F. W. Royce, of Washington, D. C., favored his New York friends with a brief visit last week.

Mr. John I. Sabin, of San Francisco, arrived in New York last week making his headquarters at the Electric Club.

Mr. H. M. Underwood has severed his connection with the Interior Conduit and Insulation Company, of New York.

Second vice-president Samuel Insull, of the Edison General Electric Company, has just returned from an extended Western trip.

Mr. Charles R. Huntley, of Buffalo, N. Y., president of the National Electric Light Association, made a flying trip to New York last week.

Mr. Henry J. Conant, well-known in the electrical field, will wed Miss Elizabeth Abbott at Watertown, Mass., October 15. The REVIEW extends its best wishes.

Mr. W. A. Hathaway, a well-known and deservedly popular member of the staff of the American Electrical Works, at Providence, led to the altar on the 15th one of his city's most attractive young ladies. The REVIEW most cordially congratulates Mr. Hathaway.

Mr. Dwight B. Dean, of Chicago, and Miss Mary E. Sisson were married Wednesday, October 7. Mr. Dean, formerly with the REVIEW, is now an able representative of the Electric Merchandise Company.

TELEGRAPHIC

.... All the wires for the district messenger service at Vancouver, B. C., are now up. Nearly 700 boxes in all will be put in at Victoria, Vancouver and New Westminster.

.... The writing telegraph was exhibited at Chicago last week. The test was between Chicago and St. Paul, over 400 miles, and despite unfavorable weather the result was successful.

... Mr. George Gould was last week quoted in Wall street as saying that Western Union earnings are so large and the surplus is so rapidly increasing as to warrant an advance of at least one per cent. in the dividend rate.

.... During the autumn manœuvres of the Austrian cavalry, a telegraphic equipment, specially designed for field use, was tested, and gave complete satisfaction. The apparatus and batteries are placed in two small boxes, one of which can conveniently be carried on each side of a saddle. A line of 20 kilometres was laid in two hours. Each of the 41 regiments taking part in the manœuvres was provided with one of these portable sets of apparatus.

Thanking Mr. Carroll.

At the last meeting of the executive committee of the National Electric Light Association, a very complimentary and deserved resolution was unanimously passed thanking Mr. John Carroll, of the Eugene F. Phillips Electrical Works, of Montreal, Canada, for his untiring and eminently successful labors in connection with the reception of the Association during its convention at Montreal. These resolutions were ordered engrossed and presented to the above named gentleman.

ADDITIONAL LIST OF NEW CORPORATIONS.

Chicago, Ill.—Suburban Light, Heat and Power Company; capital, $50,000. Incorporators, Louis W. Johnson, Ernest C. Barrows, Henry C. Joslyn.

Cornwall, N. Y.—Cornwall Electric Lighting and Power Company; capital, $15,000. Promoters, Thos. Taft, S. B. Young, Henry W. Chadeayne, all of Cornwall.

Chicago, Ill.—Heat, Light and Power Company; capital, $20,000. Promoters, David E. Davis, Theo. Barratt, Wm. Barratt, Thos. Donald Mackay and Ernest Kaufmann.

Athens, Pa.—Athens Electric Light, Heat and Power Company; capital, $5,000. Promoters, Howard Elmer, Waverly, N. Y.; Wm. Stevenson, Sayre, Pa.; Wm. A. Stevenson, Sayre, Pa.

Chicago, Ill.—Acme Light, Heat and Power Company, of Illinois; capital, $2,000,000; to hold the franchise for exclusive privileges of the entire Columbian light, heat and power system. Incorporators, George S. Knapp, James A. Turner, S. J. M. Bear.

Chicago, Ill.—The Proctor Electric Fleet Company, to fit out a fleet of electric barges to carry passengers in and about the city of Chicago in connection with the World's Fair; capital, $30,000. Incorporators, Daniel R. Proctor, Holles D. Holden and Harry H. Myers.

Jersey City, N. J.—Edison Electic Light and Power Company of Jersey City; capital, $500,000. Promoters, B. M. Jarvis, C. B. Van Dyke, D. E. Cleary, P. G. Van Zandt, B. A. Watson, Jas. Warner, J. D. Carscallen, F. J. Matthews, H. L. Lembeck, A. Q. Garretson and Wm. F. Abbett, all of Jersey City.

* * Capitalists are figuring upon an electric railroad from Alpena to Long Lake, Mich.

* * An electric road between Erie and North East, Pa., is talked of. The distance is 13 miles.

* * Electric cars at Vincennes, Ind., started last week, and the Mayor and council took a free ride.

* * Arrangements are in progress to change the present Astoria, Ore., street railway system into an electric street railway. The intention is to begin work as soon as suitable poles can be secured on which to string the wires. A 100 horse-power engine and an 80 horse-power dynamo have been ordered.

* * Capitalists of Womelsdorf, Pa., are contemplating building an electric road from that place to Millersburg, Rehrersburg and Strausstown. The length of the line would be about 12 miles, and it will connect a rich farming community, which now has no railroad accommodations, with the P. & R. Railroad at Womelsdorf.

* * The Electric City and Illinois Railway Company has filed a statement that at a meeting of the stockholders held in Madison, Ill., September 26, the name of the company was changed to the Madison, Illinois and St. Louis Railway Company, and the capital stock was increased from $50,000 to $500,000, for which amount bonds are to be issued. The number of directors is to be increased from five to eleven.

* * The people of Clinton, Mass., which has a population of about 10,000, have long felt the need of better communication by rail with Worcester. The only way of going to that place is by the Boston and Maine Railroad. The rail distance is nearly 17 miles, and the fare is 50 cents. The train service is very poor. There are only six trains a day and they run on a go-as-you-please plan. An electric railway is being seriously discussed.

* * Stockholders of the Buffalo, Kenmore & Tonawanda Railroad Company, which proposes to connect Tonawanda and Buffalo, N. Y., with an air line electric railroad, met last week and elected the following officers for the ensuing year: President, Daniel F. Callahan; secretary, Frederick E. Sykes; treasurer, Harvey W. Putnam; attorney, George B. Frost, all of Buffalo. These and 11 others form the board of directors.

* * Hon. John S. Wise, counsel to the Thomson-Houston Electric Company, was examined as a witness in favor of Gen. Slocum's electric road, on Ninth avenue, Brooklyn, before the Trolley Commissioners last week. Gen. Slocum wants to substitute the single overhead trolley system for horse-power, and his project is opposed by Sidney V. Lowell and a number of other property owners. Mr. Wise said that the trolley wire would not be at all dangerous to human life if properly put up.

* * Advices from Taunton, Mass., under date of September 29, state: Parties interested in a new electrical railway from this city to Fall River, running through Dighton, North Dighton, Weir, Somerset and Pottersville, have been here looking the ground over, and are reported as being so favorably impressed with the project that they have determined to push the matter. The rails would run along the shore road, and trains would be run often enough to satisfy all demands for freight or passenger accommodations. The movers are Boston, Taunton and Fall River capitalists.

Transmission of Power by Rotary Currents.

Although the scientific press has contained much of late descriptive of the rotary current motors used in the transmission of power system between Lauffen and Frankfort, almost nothing has been said of the transformers used in this system, which constitute one of its most essential features. The rotation of magnetism in an iron ring, by reason of shifting consequential polar points, produced by the reaction of two or more alternating currents of phasial difference, is accompanied, when the number of currents is small, by high self-induction, which, by opposing the flow of current, undoubtedly reduces the efficiency of the motor. Mr. Dobrowolsky has shown in a very clear paper written upon this subject, and heretofore published in the REVIEW, that with an increase in the number of currents contributing to the rotation of magnetism, all having a phasial difference, the extent of self-induction becomes of less and less importance.

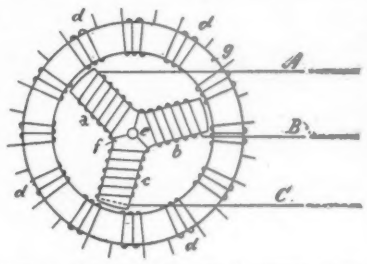


FIG. 1.—ROTARY CURRENT TRANSFORMER.

It would, therefore, be desirable to carry a large number of independent alternating currents, all differing in time phase, through independent circuits in the ring of the rotary current motor. The expense of copper for line wires, however, limits for commercial uses the number of mains which can be used between the generating and supplied station. So Mr. Dobrowolsky imposed upon himself the task of developing at the terminal stations a large number of currents all differing in phase, in spite of the fact that only three line wires were used. The basic idea of his invention will be understood from an inspection of the accompanying diagram, Fig. 1, wherein is shown a ring of iron wound with a number of independent coils. A three-legged iron core is placed within the ring and wound with three coils terminating in a common point *e*. If, now, a generator be connected to the terminals A, B, C, and such a generator is wound to deliver three alternating currents, a third of a wave length apart, each of the three wires A, B, C, will in turn become the path of the current entering the transformer, and the remaining two will constitute a return. This will develop in the three arms of the iron core rising and falling magnetism, which by induction will re-act upon the ring core. At a given instant the magnetism in one leg will be very strong, while that in the other two will be rather weak. The next instant the stronger will begin to weaken, while one adjacent to it will rise toward a maximum. The inductive effect of the three legs upon the iron ring will result in the production of consequent magnetic poles in the ring, which, by reason of the variability in strength of the magnetism in the three legs, will shift and undergo rotation through the ring. This rotation develops in each one of the coils wound around the ring an induced current, and inasmuch as the lines of force in their sweep through the ring cut the several coils at different instants of time, the currents induced in the coils will occur at different instants of time, and being alternating currents will have a uniform phasial difference. Thus we may develop by the conjoint action of three currents flowing through the mains A, B, C, as many independent alternating currents as desired, and all of these may be carried to a rotary current motor. By reversing the process a generator constructed to develop a large number of currents having a phasial difference may be transformed into three currents in the mains A, B, C, so if a system be provided with such a generator at the power station, and the three line wires be connected with such a transformer at the receiving station, three line wires may be made to act with the same degree of efficiency, so far as the interference of self-induction is concerned, as if a much larger number were used. It is evident that two alternating currents a quarter of a phase apart might be used, instead of three, or, in fact, any arrangement of circuits which will develop with two or more alternating currents traveling poles in an iron ring. A modified form of Mr. Dobrowolsky's transformer is illustrated in Fig. 2, which also shows the secondary circuit in which the motor is placed. In this case the three main wires, A, B, C, are wound about an iron bar provided with teeth confronting cooperating teeth in another iron bar upon which are wound the secondary circuits. The three main wires, A, B, C, are connected so as to produce a traveling consequent pole longitudinally through the iron of the lower bar, and this, by re-acting on the secondary core, develops in each of the secondary coils wound thereon alternating currents having a difference of phase. The secondary coils may be connected with as many local distributing circuits as desired. As shown in the diagram, they are connected with four distributing circuits, which are wound about the iron ring of the motor so as to develop a rotation of magnetism. It will thus be seen that by two or three currents transmitted over a main line any desired number of currents differing in phase may be led into the motor. By this system it is possible that even a single circuit of two wires might be used to develop a large number of differing currents, as, for example, by carrying the mains through an ordinary transformer and using the secondary of such transformer in conjunction with the mains to develop consequent poles and produce a rotation of magnetism, this rotation of magnetism in turn being used in accordance with the principle of Mr. Dobrowolsky's invention to develop as many alternating currents having a phasial difference as may be desired. This system of transforming a small number in a large number of currents, or *vice versa*, is one of the most clever and ingenious features of the rotary current system.

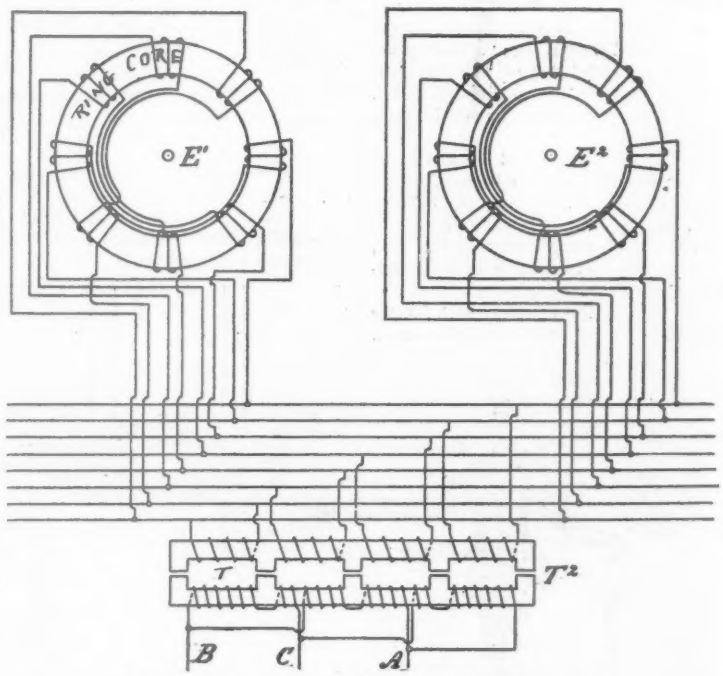


FIG. 2.—ROTARY CURRENT MOTORS AND TRANSFORMER.

The Toledo Electric Street Railway Company has decided to erect a large car barn on the corner of Galena and Ontario streets. The company has closed a deal by which it will acquire a tract of land located at the above named point, and will begin the work of constructing the barn this week. The building will be 175x125 feet and will have accommodation for 75 cars. It will be frame and one story in height.

Los Angeles Electric Railway Wins.

The Supreme Court has disposed of the well-known case of the Pacific Railway Company *et al.* against Judge Wade of Los Angeles, Cal., in an elaborate opinion. The public interest was incited by an argument for a writ of prohibition against Judge Wade to prevent him from assessing the amount of damages for and granting the right of way over the street cable road of the petitioners to the Los Angeles Consolidated Electric Railway Company.

The gist of the decision is embodied in the following:

"There can be no private property in a street, except the fee of the owner, which is held subject to the easement as long as the public continue to use the street as a highway. The maintenance of horse railroads and running of cars upon public streets of the city of Los Angeles, for the carriage of passengers, is a mere special mode of using the highway, nothing more. The right to maintain such a railroad does not exclude the public from using the street. The opinion, therefore, sustained the action of Judge Wade and held that the property of the petitioners is in *custodia legis*, and therefore the court can grant a right of way to any person or corporation and assess damages and compensation to be paid therefor, without citing or consulting the corporation, but simply upon the application of the receiver in possession of its property. The writ of prohibition against Judge Wade was therefore dismissed."

This decisive victory for the Los Angeles electric road means a great deal for other roads that are now similarly situated, and will save them the expense of much litigation.

GENERAL NOTES.

General W. F. Lansing has been awarded the contract to light the streets of Little Falls, N. Y., by electricity for five years.

Mrs. Theo. Larbig has sued Darwin J. Meserole for $5,000 damages for the loss of her husband, Theodore Larbig, whom, she says, Meserole killed. Larbig was well-known in electrical circles. He met his death in June last in a flat kept by Mrs. Dovie Comstock, in Brooklyn.

A corporation has been formed in New York city to take over the *Journal of Railroad Car Heating*, which has been rechristened the *Railroad Car Journal*. Its sphere of operation has been extended so as to cover every feature connected with the improvement and perfection of the passenger car. The paper has been enlarged and will continue to be published monthly. Mr. Edward A. Phillips is the editor and manager.

Recent Tests of the Robinson Radial Car.

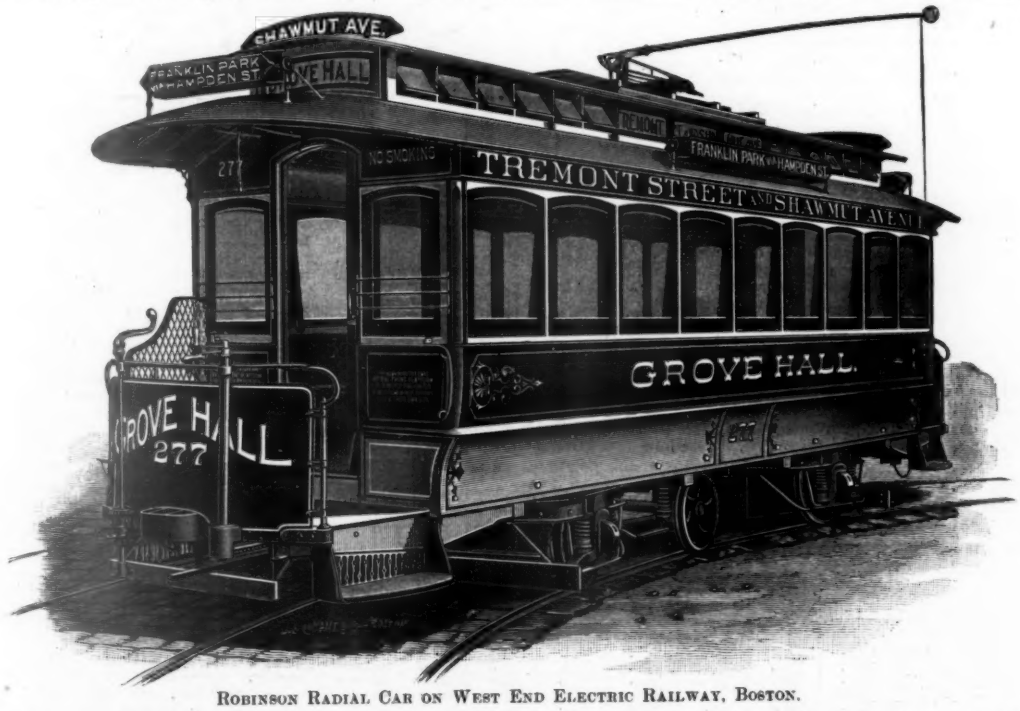
In a competitive test recently made on the West End Railway in Boston, Mass., between the Robinson radial and an eight wheeled car, when the weights of the cars were equalized, and they made an all-day run *on a straight track*, loaded with seven tons of meal, the eight wheeled car consumed an average of about six per cent. more power than the radial. The eight wheeled car blew a number of fuses during the test, but the radial did not blow any.

The difference in operation between the Robinson and the eight wheeled car was incidentally, but forcibly, illustrated after the completion of this test. In proceeding to the car house at Grove Hall, the radial, with its load of seven tons of meal, easily climbed the heavy Warren street grade without any trouble and without blowing any fuses. The eight wheeled car, however, on reaching this grade, blew its fuses, got stalled and was helped up the grade by another motor car pushing behind.

Since the above test was made, another still more interesting test has been made which shows much greater results in favor of the radial than indicated above.

The last test, which was made a short time ago, is embodied in the following letter of Mr. F. S. Pearson, chief engineer of the West End Railway Company, addressed to Mr. William Robinson, general manager of the Robinson Electric Truck and Supply Company.

The test described in this letter illustrates the wonderful traction of the radial truck and shows that with a single 15 horse-power motor it accomplished even greater work than the eight wheeled car above described was able to accomplish with its full equipment of two 15 horse-power motors.



Robinson Radial Car on West End Electric Railway, Boston.

WEST END STREET RAILWAY COMPANY.
Electric Department, 61 Milk Street,
Boston, Oct. 7, 1891.

F. S. Pearson, chief engineer; L. S. Dumoulin, electrical engineer; L. J. Hirt, mechanical engineer.
William Robinson, Esq., 180 Summer street, Boston.

Dear Sir: Some time ago we made a test with a Robinson radial car, in Cambridge, to determine whether it would be possible to operate a car of this sort with one motor. In order to make the test, one of the motors was disconnected, and the axle gearing taken off, so that the car was operated entirely by a single S. R. G. Thomson-Houston motor.

We had no difficulty in making time over the Cambridge line, at one point of which there is a 6¼ per cent. grade. During the test the car was loaded with 15,000 pounds of meal, which is equivalent in weight to a maximum load of passengers.

From the tests it was shown that enough traction can be obtained from one pair of wheels with the Robinson truck to operate under all conditions of travel which might arise in the Summer months.

Yours truly, F. S. Pearson.

Gillette & Lewis, Cleveland, O., are installing an electric passenger elevator for The H. M. Brown Dry Goods Company, of the same city, using a 10 horse-power Connecticut motor in connection with the Geo. W. Barrett elevator.

J. H. Bunnell & Company's Pocket Galvanometer Battery Gauge.

This device consists of a pocket galvanometer of such construction and calibration as to furnish a reliable standard for practical measurement of current strengths, in test ing from one to five cells of ordinary batteries, such as the various forms of sal-ammoniac, sulphate of copper and acid batteries. The reading is such that a good Leclanche cell indicates about 9°; Burnley dry battery, 4°; Lockwood American District (blue vitriol), 6°; Crowfoot, Western Union form, 8°.

J. H. Bunnell & Company's Pocket Galvanometer Battery Gauge.

As these gauges are all calibrated to a single standard and are made exactly alike, their introduction furnishes an accurate instrument for comparisons, or condition tests, of from one to five cells. The gauge being a true galvanometer and not dependent for its action on springs or electro magnetic devices, its indication is always the same for a given force.

The galvanometer gauge is arranged for use either standing upright on instrument table or desk, or, as when used for miscellaneous testing in battery room, etc., it is held suspended by the chain and ring, in which position, without current, the needle hangs at zero the same as it would if the galvanometer were standing on a table.

These galvanometer gauges are especially advantageous for use as permanent circuit indicators for fire alarms, burglar alarms, district telegraphs, etc., on account of their presenting the face of the instrument in an upright position.

For all the purposes for which it is available one particular feature of its practical merit consists in the fact that the action of the needle is perfectly "dead beat," that is, the needle moves at once to whatever indication the current calls for and remains there without oscillation as long as the current continues.

Two silk-covered conducting cords are attached to each gauge, and these cords are provided with a very convenient form of improved tip, which is so made that it can enter any ordinary binding post and be held by the binding screw in the usual way, or, being a square end tip, is suitable for English binding posts, and also having a spring clamp it can be hooked firmly on to bare wire (office wire size or less) at any exposed point. This form of tip is extremely handy in all experimental temporary wire connecting, and by its use with the gauge the condition of any one to five cells in the middle of series can be instantly ascertained without making breaks and reconnecting.

The Edison Illuminating Company, of New York, has declared its twenty-sixth quarterly dividend of one per cent., payable to stockholders of record November 2.

We publish in another place in this issue an interesting article on the effects of the arc light on growing plants. The results of these experiments are so encouraging as to warrant further and more extended investigation. We may yet obtain early crops of vegetables from the electric light forcing houses.

ELECTRIC LIGHT NEWS

—— Taylor, Tex., wants electric lights.

—— The Chester, Pa., Electric Light and Power Company are gradually introducing the meter system.

—— A dividend of three per cent. has been declared by the Electric Light and Power Company at Washington, Pa.

—— The Fall River, Mass., committee on streets last week presented a report against adopting a system of municipal lighting.

—— The utilization of Mitchell's Falls, which lie between Haverhill and Lawrence, Mass., for the generation of electric light and power, is being agitated.

—— Mr. J. S. Davis has resigned as secretary and manager of the Albany, N. Y., Edison Illuminating Company, and Mr. M. D. Gartatowsky has been elected as his successor.

—— The common council of Edgerton, Wis., has granted a franchise to a local company for the purpose of lighting the city by electricity. It is expected the plant will be in operation before snow falls.

—— At the October meeting of the city government of Biddeford, Me., the matter of lighting the streets came up on the report of the committee and it was voted to contract with the Consolidated Electric Light Company for one year for $33,000.

—— The Santa Ana, Cal., *Blade* says a ruralist's first sight of the new electric lighting apparatus there elicited this: "Wall, wall, now I'd jess like ter know what this 'ere town of Sant Ann is a comin' to anyhow. The newspapers says tha've put in water works, an' now gol darn my cats, ef they ain't a putten up fire bells with glass clappers to 'em at every street corner."

—— A fire in the Stevens Point, Wis., Lighting Company's plant caused a damage estimated at $5,000. Most of the roof of the building was burned away before it could be put out, and the dynamos and other machinery were seriously damaged by fire and water. The fire started from a spark in the boiler room. But a small insurance was carried by the company.

Electric Light Companies Liable to Taxation.

In the Supreme Court, October 5, at Pittsburgh, a decision was handed down affirming Judge Simonton's decision in the suit between the Commonwealth and the Northern Electric Light and Power Company. Something over a year ago the electric light companies resolved to contest their liability to taxation, claiming to be exempt as manufacturing corporations.

The case of the Northern Electric Light and Power Company was made a test, a great many others depending upon it Judge Simonton decided against the corporations and in favor of the State, holding that electricity was not a material substance and could not, therefore, be considered a manufactured article. The companies appealed to the Supreme Court, but Judge Simonton's opinion, which was a very elaborate and learned one, has been fully sustained, and the companies will be compelled to pay the taxes.

Several years' taxes of a large number of companies were involved, and the revenues of the State will be benefited by this decision. Judge Simonton's decision against the Edison Electric Company is also affirmed.

A case decided by Judge Simonton against the Brush Electric Light Company is reversed, and the decision is in favor of the company. This decision does not involve the manufacturing question.

ELECTRO-CULTURE.

(*Continued from page 109.*)

frame February 1, and in two weeks, having received only electric light, it was dead.

Another series of tests was made by covering well established plants in the beds. A tight box, 18 inches square and a foot high, was placed over certain plants during the daytime, and was removed at night and placed over contiguous plants of the same kind. Thus one set of plants received only electric light and one only sunlight, and inasmuch as both were covered during half of the 24 hours, any error which might have arisen from the covering itself—as lack of ventilation and increased heat—was eliminated. February 7 certain radishes in the

FIG. 3.—SIX BEST TUBERS OF SCARLET FRAME RADISH FROM DARK AND LIGHT (ELECTRIC) HOUSES.

light house which had been planted two weeks were covered. In eight days some of the plants which were covered during the day were dead and the remaining ones were very weak. At the same time those which were covered during the night had made a better growth than they had before and better than contiguous plants which had not been covered. An examination of the leaves of the plants receiving only the electric light showed that they contained no starch and very little or no chlorophyll. February 8 two lots of beans and radishes were planted in pots sunk to their brims in the soil between the radish rows in the light house. One lot was covered during the day and the other during the night, as above. Germination was the same in both lots. February 25 the daylight beans had made a stocky growth of 3½ to 4 inches, while the electric light lot had made a weak growth of 8 to 9 inches. Radishes behaved in a similar manner. March 3 the leaves of the electric light beans began to wither, and both beans and radishes were dead March 10. The daylight lots continued to grow thriftily.

On February 15 two strong plants of German ivy (*Senecio scandens*), carnation and begonia, were selected for a similar experiment. One plant of each was covered by day and the other by night. February 28 the electric light ivy appeared as if dying, and March 10 it was apparently dead. By March 3 the electric light carnation was seen to be making an etiolated growth. A month later the new white growth had become four to six inches long. The electric light begonia began to drop its leaves March 5, and a month later all the leaves had fallen. Another begonia, which chanced to be standing in diffused electric light, did not lose its leaves. By the middle of March the ivy threw up a shoot from the root, but the sprout remained feeble. April 3 the boxes were removed entirely from both lots. The contrasts were most striking. The daylight plants were strong and dark colored, while the others were dead, or nearly so. From that time until the close of the experiment for the season, April 12, all the plants had the same conditions, daylight and electric light at night. A week after the experiment had closed, and the electric light had been stopped, the begonia began to send out new leaves, the new shoot on the ivy began to assume a natural color and habit, but the carnation plant was nearly dead and apparently past recovery.

Peas were also treated in a similar manner. A row of peas which had grown for a month in direct electric light and which was in ordinary health, was divided into two equal parts and covered. In 14 days a part of the electric light lot was dead, and the others were rapidly dwindling, while the daylight plants had improved. At this time the boxes were permanently removed, but the remaining electric light plants did not recover, and soon died.

The above experiments show conclusively that within the range of an ordinary forcing-house the naked arc light running continuously through the night is injurious to some plants; and in no case did we find it to be profitable. But the fact that the light hastens maturity, or seed bearing, suggests that a modified light may be useful under certain conditions. Our next step, therefore, was to temper the light by the use of a globe.

EXPERIMENTS WITH A PROTECTED LIGHT RUNNING ALL NIGHT.—(1890.)

Early in March, 1890, an ordinary white opal globe was placed upon the lamp, and for five weeks experiments similar to those already described were conducted. The effect of the modified light was much less marked than that of the naked light. Spinage showed the same tendency to run to seed, but to a much less extent, and the plants were not affected by proximity to the lamp. Lettuce, however, was decidedly better in the electric light house. Radishes were thrifty in the light house, and the leaves did not curl, but they produced less than in the dark house, although the differences were much less marked than in the former experiments. These second series of experiments can scarcely be compared with the former ones, because of the greater amount of sunlight which the plants received in the lengthening days of Spring. The figures obtained from radishes, however, may afford a practically accurate comparison, because of their rapid growth. The following, Table B, should be compared with Table A.

The loss due to the electric light averages from one to five per cent. in the different comparisons, while the loss occasioned by the naked light was from 45 to 65 per cent. It is noticeable, also, that while the tops or leaves were lighter under the naked light, they were heavier under the modified light than those of normal plants; and this is interesting in connection with the fact that lettuce did better under the modified light than in the dark house.

The figures show that the plants which grew directly in front of the lamp were but little inferior to those which stood 10 or 12 feet away, or even to those in the dark house. No other plant in our experiments has withstood the electric light so well.

Observations were made toward the close of the experiment upon the influence of the light on the blooming of plants, but the subjects were not numerous enough to enable us to draw definite conclusions. There was little difference in the length of time which flowers lasted in the two compartments. Flowers of primula and cineraria appeared to last longer by a day or so in the light house, while begonia and zonal geranium persisted rather longer in the dark house. These may have been incidental variations, and the subject was subsequently more fully investigated, as will appear in the sequel.

we used a 10 ampere, 45 volt, 2,000 nominal candle-power Westinghouse alternating current lamp. Radishes, lettuce and a variety of ornamental plants were grown, mostly tulips, verbenas, petunias, primulas, heliotrope and coleus. These ornamentals were mostly named one colored varieties, and they were grown to enable us to make observations concerning the influence of electric light upon color. In this experiment the lighting of the compartments was reversed during the last month, in order to eliminate any error which might arise from any minor differences in the temperature or other conditions of the two portions of the house. In order to properly understand the significance of the observations which follow, the reader will need to consult the following record of the dates and hours of lighting:

TABLE C.

Dates.	Light ran from	No. of hours run.	Dates.	Light ran from	No. of hours run.
Jan.			Mar.		
16	5 to 7 P.M.	2	11	6 to 11	5
17	5 to 6	1	12	6 to 11	5
18			13	6 to 11	5
19	5 to 7	2	14	7 to 11	4
20	5 to 7	2	15		
21			16		
22	5 to 8	3	17		
23	5 to 7	2	18		
24	5 to 6	1	19		
25			20		
26	5 to 10	5	21		
27	5 to 10	5	22		
28			23		
29	5 to 11	6	24		
30	5 to 6 A.M.	13	25		
31	5 to 11	6	26	7 to 8	1
Feb.			27	7 to 8	1
1	5.30 to 11	5½	28	7 to 11	4
2	5.30 to 11	5½	29	7 to 11	4
3	5.30 to 11	5½	30	7 to 11	4
4	5 to 11	6	31	7 to 11	4
5	5 to 11	6	April		
6	5 to 11	6	1	7 to 11	4
7	5.30 to 11	5½	2	7 to 11	4
8	5.30 to 11	5½	3	7 to 11	4
9	5 to 11	6	4	7 to 11	4
10	5 to 11	6	5	7 to 11	4
11	5 to 11	5	6	7 to 11	4
12	5.15 to 11	5¾	7	7 to 11	4
13	5 to 11	6	8	7.30 to 11	3½
14	5.15 to 6	¾	9	7.30 to 11	3½
15			10	7.30 to 11	3½
16	5.15 to 8	2¾	11	7.30 to 11	3½
17	5.15 to 8	2¾	12	7.30 to 11	3½
18	5.15 to 8.30	3¼	13		
19	6 to 8.30	2½	14		
20	5.30 to 8.30	3	15		
21	5.30 to 8	2½	16		
22			17		
23	6 to 7	1	18		
24	5.30 to 8	2½	19		
25	5.30 to 8.30	3	20		
26	5.30 to 8.30	3	21		
27	5.30 to 11	5½	22		
28	6 to 11	5	23		
Mar.			24	7.30 to 12	4½
1	6 to 11	5	25	8 to 10.30	2½
2	6 to 11	5	26	7.30 to 11	3½
3	6 to 11	5	27	8 to 11	3
4	6 to 11	5	28	8 to 11	3
5	6 to 11	5	29	8 to 11	3
6	6 to 5 A.M.	11	30	8 to 11	3
7	6 to 11	5	May		
8	6 to 11	5	1	8 to 11	3
9	6 to 11	5			
10	6 to 11	5		Total.....308 hours.	

Of radishes, the White Box and Cardinal Globe were grown. The foliage was notice

TABLE B.

VARIETY.	Average weight of entire plant.		Average weight of top.		Average weight of tubers.		No. of marketable tubers.	
	Light house.	Dark house.	Light house.	Dark house.	Light house.	Dark house.	Light house.	Dark house.
Half-long Rose	.41 oz.	.41 oz.	.19 oz.	.16 oz.	.22 oz.	.25 oz.	84 pct.	97 pct.
" "	.26 "	.34 "	.12 "	.14 "	.14 "	.20 "	76 "	87 "
Scarlet Globe	.24 "	.26 "	.08 "	.08 "	.16 "	.18 "	88 "	95 "
Prussian Turnip	.28 "	.29 "	.11 "	.09 "	.17 "	.20 "	100 "	100 "
" "	.27 "	.33 "	.09 "	.08 "	.18 "	.25 "	90 "	100 "
Blood-red "	.36 "	.40 "	.14 "	.15 "	.22 "	.25 "	90 "	75 "
French Breakfast	.25 "	.30 "	.13 "	.11 "	.12 "	.19 "	100 "	100 "
Half-long Scarlet	.22 "	.32 "	.08 "	.08 "	.14 "	.24 "	85 "	100 "
Average	.29 oz.	.33 oz.	.12 oz.	.11 oz.	.17 oz.	.22 oz.	89 pct.	94 pct.

We had now found that the injurious effects of the electric lamp are lessened by the use of a thin globe, probably because glass cuts off the highly refrangible and invisible rays. The globe distributes the luminous rays more evenly, and probably absorbs a few of them, but the injury was lessened to an extent out of all proportion to the amount of modification in light; and we had found that lettuce and the leaves of radishes had grown larger under the light than in ordinary conditions. These facts indicate that there may be conditions under which the electric light can be made profitable to the gardener, and they suggested the experiments of the succeeding Winter; and here the investigations for 1890 closed.

EXPERIMENTS WITH THE NAKED LIGHT RUNNING A PART OF THE NIGHT.—(1891.)

From January 16 to May 1, 1891, the experiment was conducted under new conditions. The arrangement of the house or compartments remained as before, but the lamp was connected with a street lighting system and the light ran but a few hours, and never on moonlight nights. In this test

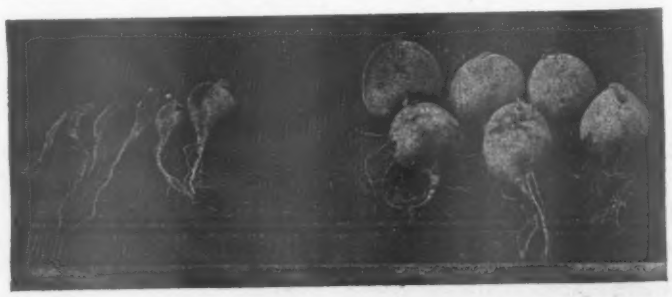


FIG. 4.—SIX BEST TUBERS OF WHITE BOX RADISH FROM DARK AND LIGHT (ELECTRIC) HOUSES.

ably larger in the electric light house, as it had been under the modified light, but the tubers were practically the same in both houses, and the date of maturity was the same. Notwithstanding its greater size, the foliage in the light house showed some signs of curling.

American Wonder and Advance peas were grown, and in every case they were larger and more fruitful in the dark house. The electric light did not increase the size of leaves, as it did in the radishes. These results are similar to those obtained in 1890.

The lettuce, however, was greatly benefited by the electric light. We had found that under the proteeted light the lettuce had made a better growth than in normal conditions, but now it showed still greater difference. Lettuce of two varieties, Landreth Forcing and Tennis Ball, or Boston Market, was transplanted onto bench No. 4 when the light started. Both varieties were planted in each house, and the plants were all alike; and all the conditions in the two compartments were kept as nearly alike as possible. Three weeks after transplanting (February 5), both varieties in the light house were fully 50 per cent. in advance of those in the dark house in size, and the color and other characters of the plants were fully as good. The plants had received at this time 70½ hours of electric light. Just a month later the first heads were sold from the light house, but it was six weeks later when the first heads were sold from the dark house. In other words, the electric light plants were two weeks ahead of the others. This gain had been purchased by 161¾ hours of electric light, worth at current prices of street lighting about $7.00.

This lettuce test was repeated and was watched very closely when the lamp was transferred to the compartment which had formerly been kept under normal conditions. The same results were obtained, and the differences in the two crops were so marked as to arrest the attention of every visitor. The electric light plants were in every way as good in quality as those grown in the dark house; in fact, the two could not be told apart, except for their different sizes. The variety in this case is Landreth Forcing. The history of the plants is as follows: The seeds were sown in flats February 24. Until March 17 they were grown under ordinary conditions, at which time they were set in their permanent positions in the two compartments. We began to pick lettuce from the light house April 30, but the first of equal size from the dark house was obtained May 10. The electric light plants were, therefore, upon the benches 44 days before the first heads were sold. During this time there were 20 nights in which the light did not run, and there had been but 84 hours of electric light, worth about $3.50. In order to compute the cost of growing lettuce by the aid of the electric light, it is necessary to know how far the influence of the light will extend. This we do not know; but the lamp exerted this influence throughout a house 20x30, and the results were as well marked in the most remote part as they were near the lamp.

The results obtained from lettuce suggest many questions, all of which must be answered by experiment. We need to know if there is any particular time in the life of the lettuce plant when the light has a predominating influence; if a mild light is as good as a strong one; if the failure of the light during the moonlight nights is a serious drawback; to what distance the influence of the light extends; if the same results can be obtained by hanging the lamp over the house, instead of inside it, and by that means lighting several houses at once; if other plants can be profitably forced by means of electric light? In all these directions, and many others, we are planning experiments for the coming years.

The influence of the light upon productiveness and color of flowers was found to vary with different species and different colors within the same species. Several named varieties of tulips gave interesting results. Careful observations were made upon Proserpine, light cherry color; Wourseman, maroon; Vender Neer, light cherry; Yellow Pottebakker, bright yellow; Belle Alliance, scarlet, and Cerise gris delin, cherry and white. Upon the 13th of February, when these came into full flower, it was found that in every case the colors were deeper and richer in the light house; but the colors lost their intensity after four or five days and were indistinguishable from those in the dark house. The plants in the light compartment had longer stems and larger leaves than the others; and there was a greater number of floriferous plants in the

light. The tulips were grown at a distance of 10 and 12 feet from the lamp.

Verbena flowers near the light were uniformly injured. February 26, all plants within six feet of the light were stunted, the leaves were small and curled, and the flowers were short-lived. The flowers were small, and those on the lower part of the clusters turned brown and died before those on the top opened. The buds within two or three feet of the lamp curled up and shrun k and became discolored before opening, but the discoloration did not extend to the inside of the flower until it had opened. Scarlet, dark red, blue and pink flowers within three feet of the light soon turned to a grayish-white, and this discoloration was noticeable to a distance of six and seven feet. The plants bloomed somewhat earlier in the light house than in the other. Fig. 5 shows the influence of the electric light upon verbenas. The left specimen stood four feet from the lamp, and the right hand specimen is from the dark house. In Fig. 5—which shows a white-flowered variety—the electric light specimen is much dwarfed and weak and it could not stand alone. It is nearly past flowering, while its companion is in good condition. At a distance of nine and ten feet from the light, verbenas grew tall and slender, even taller than in the dark house, and the difference in the time of flowering was very little.

A few fuchsias were grown in both houses. Those in the light house were about eight feet from the lamp, and they flowered three days earlier than the others. The colors were not changed.

Heliotropes of various named varieties standing nine and ten feet from the lamp did not appear to be affected in any way.

White ageratums stood at three feet from the lamp. The flowers soon turned brown and sere. Those in the dark house remained white three times as long.

Chinese primulas at seven feet from the light were not affected, but those four feet away, especially the lilacs, were changed in color. The lilac was bleached out to pure white wherever the light struck squarely upon the flowers, but any portion of the flower which chanced to be shaded by a leaf or another petal retained its color for a time, and then gradually became duller. The exact shape of the shadow could be distinguished during the day. It was noticed that the bleaching was most apparent when the lamp had not been running for a few days; but this was simply because the loss of color took place within a few hours, rather than slowly, from the opening of the bud.

Petunias were much affected by the light. The plants were much taller and slenderer in the light, even at the farthest corners of the house, and they bloomed earlier and more profusely. February 24, when measurements were taken, it was found that the height of the plants in the dark house was to height of those in the light house as five is to six. Fig. 6 shows the difference well. The three front plants (A, B, C) grew 14 feet from the light, and the rear plants (D, E, F) grew in the dark house. White petunias were not changed in color by the light, but purple ones quickly became blue, especially near the lamp. The flowers near the light shrunk in size the first day or two and the texture became thin and flabby. During the moonlight nights of March, when the light was not running, many purple petunias opened near the lamp. The first night following the lamp burned six hours, and the next morning nearly all the flowers within five feet were blue where the light had struck them squarely, and later they changed to a dirty white. Flowers which opened when the light was running every night were not so soon affected.

FIG. 6.—EFFECT OF ELECTRIC LIGHT UPON PETUNIAS.

Coleus plants of various colors were placed at different distances from the lamp March 31. After two nights the plants within three feet of the lamp were much affected. Reds became yellow, browns turned to green, greens lost their brightness, and dark purple became glossy black. Whenever shadows of other leaves protected the foliage the color was unchanged, and the precise limits of the shadow, even to the teeth of the overhanging leaves, were visible for days afterwards. Plants five feet away were little affected at this time, and those 12 feet away were unchanged. Five days later, brown foliage seven feet from the lamp had become greenish in color. During April all coleuses 10 and 12 feet from the light were uninjured, but in January and February they gradually became duller in color at that distance, especially the browns, which appear to be particularly susceptible to the influence of the light. This difference between the results of April and January is undoubtedly due to the greater number of hours of electric light in the long nights of midwinter; and by a reference to the record (Table C) it will be seen that for 11 consecutive nights in April the light did not run.

Numerous auxanometer* readings were made upon representative plants in both houses during 1890 and 1891. Table D is a record of the growth of two petunia plants, alike in all respects, which will be sufficient for the present purpose.

The average growth per hour is as follows:

8 P.M. to 11 P.M.	11 P.M. to 8 A.M.	8 A.M. to 8 P.M.	8 P.M. to 11 P.M.	11 P.M. to 8 A.M.	8 A.M. to 8 P.M.
Electric light.					
.0116 in.	.0243 in.	.0312 in.	.0234 in.	.0225 in.	.0234 in.

The greatest growth took place when the electric light was burning.

In all these experiments with ornamental plants, it was noticeable that the light exercised a very injurious effect within a radius of about six feet. Between six and eight feet the results were indifferent, and beyond that point there was usually a noticeable tendency towards a taller and straighter growth, and it seemed to us that at distances of a dozen feet or more the flowers were more intense in color, particularly when they first opened. There was usually a perceptible gain in earliness in the light house, also. On the whole, we feel that it will be possible some day to use the electric light in floricultural establishments to some pecuniary advantage. If we have not determined the distance to which the beneficial influence of the light extends, we have, nevertheless, defined, with some degree of accuracy for a few species, the limits of its injurious influence.

RECAPITULATION.

It is impossible to draw many definite conclusions from the above researches. The many conflicting and indefinite results indicate that the problems vary widely under different conditions and with different plants. Yet there are a few points which are clear. The electric light promotes assimilation, it often hastens growth and maturity, it is capable of producing natural flavors and colors in fruits, it often intensifies colors of flowers and sometimes increases the production of flowers. The experiments show that periods of darkness are not necessary to the growth and developments of plants. There is every reason, therefore, to suppose that the electric light can be profitably used in the growing of plants. It is only necessary to overcome the difficulties, the chief of which are the injurious influences upon plants near the light, the too rapid hastening of maturity in some species, and, in short, the whole series of practical adjustments of conditions to individual circumstances. Thus far, to be sure, we have learned more of the injurious effects than of the beneficial ones, but this only means that we are acquiring definite facts concerning the whole influence of electric light upon vegetation; and in some cases, notably in our lettuce tests, the light has already been found to be a useful adjunct to forcing establishments.

The experiments suggest many physiological speculations upon which it is not the province of this bulletin to enter. Yet two or three of them may be mentioned. It is a common notion that plants need rest at night, but this is not true, in the sense in which animals need rest. Plants have simply adapted themselves to the conditions of alternating daylight and darkness, and during the day they assimilate or make their food and during the night, when, perforce, assimilation must cease, they use the food in growth. They simply practice an individual division of labor. There is no inherent reason why plants cannot grow in full light, and, in fact, it is well known that they do grow then, although the greater part of growth is usually performed at night. If light is continuous, they simply grow more or less continuously, as conditions require, as they do in the long days of the Arctic regions, or as our plants did under continuous light. There is no such thing as a plant becoming worn out or tired out because of the stimulating influence of continuous light.

It would seem, therefore, that if the electric light enables plants to assimilate during the night and does not interfere with growth, it must produce plants of great size and marked precocity. But there are other conditions, not yet understood, which must be studied. Our radish plants and many others were earlier, but smaller, under the influence of the light. Observation and chemical examination showed that a greater degree of maturity had been attained. Perhaps they assimilated too rapidly, perhaps the functions of the plant had been completed before it had had time to make its accustomed growth. Perhaps the highly refrangible and invisible rays from the electric lamp have something to do with it. In fact, this latter presumption probably accounts for much, if not all, of the injury resulting from the use of the naked light, for the effect of the interposition of a clear pane of glass is probably to absorb or obstruct these rays of high refrangibility. Good results which follow the use of a globe or a pane of glass show, on the other hand, that the injury to plants cannot result from any gases arising from the lamp itself, as has been supposed by some observers. In our own experiments, particularly with the Brush lamp, there was no perceptible odor from the gases of combustion; and it may also be said that commercial forcing-houses, like our own, are not tight enough to hold sufficient quantities of these gases to injure plants.

It is highly probable that there are certain times in the life of the plant when the electric light will prove to be particularly helpful. Many experiments show that injury follows its use at that critical time when the plantlet is losing its support from the seed and is beginning to shift for itself, and other experiments show that good results follow its later use. This latter point appears to be contradicted by Dehérain's results, but his experiments were not conducted under the best normal conditions.

On the whole, we are inclined toward Siemens' view that there is a future for electro-horticulture.

FIG. 5.—EFFECT OF ELECTRIC LIGHT UPON VERBENAS.

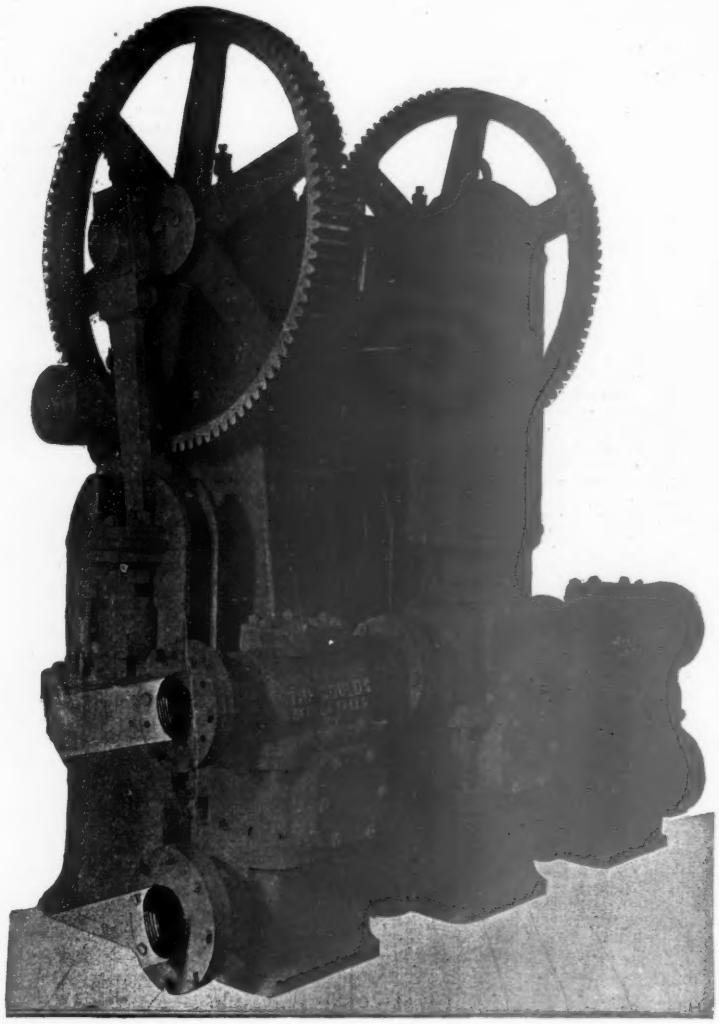
TABLE D.

DATE, 1891.	In electric light house. Plant 12 feet from the lamp.			In normal house.		
	8 p.m.—11 p.m. Electric light running.	11 p.m.—8 a.m. Dark until daylight.	8 a.m.—8 p.m. Daylight.	8 p.m.—11 p.m. Dark.	11 p.m.—8 a.m. Dark until daylight.	8 a.m.—8 p.m. Daylight.
April 27	.25 inch.	.0625 inch.	.5 inch.	.15625 inch.	.0625 inch.	.625 inch.
" 29	.1875 "	.3125 "	.125 "		.125 "	.25 "
" 30	.125 "	.125 "	.5 "		.375 "	.0625 "
May 1	.125 "	.375 "	.375 "	.125 "	.25 "	.1875 "
	.50 inch.	.875 inch.	1.5 inch.	.28125 inch.	.8125 inch.	1.1250 inch.
	Total growth, 2.875 inch.			Total growth, 2.21875 inch.		

*An auxanometer is an instrument for measuring the growth of plants. The record is usually made continuously upon a revolving cylinder connected with a clock, so that the amount of growth can be determined for any hour of the day.

Goulds Special Triplex Electric Pump.

The Goulds Manufacturing Company, Seneca Falls, N. Y., make the special triplex electric pump illustrated herewith. It has three single acting cylinders, the plungers are outside, guided above, and have brass bushed connecting rods of forged steel with



GOULDS SPECIAL TRIPLEX ELECTRIC PUMP.

an adjustment at either end to allow for wear. The power is transmitted directly to each plunger in this manner: A counter shaft behind the pump transmits power to spur gears at either end of the pump, driving the two outside plungers, and at the same time through the single throw supporting the crank shaft, the center or middle plunger. The bronze suction and discharge valves are all grouped in the valve chamber, shown in front of the pump base, and are accessible through hand holes or ports.

Inspection of the New Double-Deck Street Car at Pullman, Ill.

A party of gentlemen prominent in street car and financial circles, accepted, October 8, the invitation of Mr. Geo. M. Pullman, to visit the Pullman Palace Car Works at the city of Pullman to investigate the new double-deck street car just finished by that company. The following gentlemen composed the party: Henry Villard, Milward Adams, C. C. Wheeler, S. B. Cobb, E. L. Powers, Murry Nelson, C. H. Chappelle, H. B. Stone, E. L. Brewster, A. Bement, F. W. Rice, H. F. Royce, G. E. C. Johnson, Williston Fish, T. B. Blackstone, Marshall Field, A. L. C. Berger, Norman Williams, Colonel Keefe, H. H. Windsor, A. B. Pullman, George F. Brown, C. S. Sweet, R. H. Southgate, H. R. Hobart, J. H. Wrenn, Gen. John A. McNulta, S. M. Jones, H. H. Porter, Judge Lambert Tree, Cyrus H. McCormick, Jesse Spalding, R. T. Crane, T. C. Crawford, John A. Logan, Jr., B. R. Mercer, W. W. Kimball, J. R. Walsh, Henry Wheeler, W. R. Moore, Gen. Horace Porter, J. L. Barkley, George M. Pullman, C. L. Pullman, T. H. Wicks.

The car combination they saw at Pullman is a new and exceedingly novel one designed especially to at least double the carrying capacity, and thereby aid in the rapid transit conundrum. It is double-decked with a seating for 40 passengers each above and below. This novel car is the joint invention of Mr. E. C. Sessions, of Oakland, Cal., and Mr. C. L. Pullman, of Chicago. Mr. Sessions being the inventor of the upper portion and Mr. Pullman of the approaches and the handsome pilot-houses situate at each end of the upper deck for use of the motorneer. Each pilot-house is fitted with the electrical appliances required in running a trolley car so that the car runs either end first. Entrance to the car is made from either side, the passenger entering a handsomely ornamented vestibule from which, for convenience, spiral stairways lead to the upper portion of the car.

The car is fitted with all modern electrical appliances, electric signal bells, beautiful electroliers and an especial electrical diagram showing what seats are vacant on the upper deck. There is also a complete outfit of the famous Burton electric heaters. Double trucks of special design, having a double and friction break attachment, are used, these being the invention of Mr. H. G. Bird, of Chicago, secretary and treasurer of the Sessions Passenger Car Company. The breaks act very simply and permit the stopping of the car within its own length when running at a speed of 15 miles per hour. The car is furnished in the usual Pullman style. Each truck is fitted with a 25 horse-power Westinghouse single reduction electric motor. The car is handsomely decorated and upholstered throughout. A party of gentlemen, directors and officers of the West End Street Railway, of Boston, visited Pullman last week at the invitation of Mr. Pullman and were very much pleased with the car, practically deciding to place an order for a goodly number of the new cars in a short time.

At the end of the trolley system, which does not run over the entire track, a surprise awaited the guests. Here the new car of the Patton Motor Manufacturing Company awaited them and was coupled on drawing the large car heavily loaded over the entire circuit of tracks in the city. This system was developed by Mr. W. H. Patton and built at Pullman, where it has been demonstrating daily for the past three months its wonderful capabilities. This system was illustrated and fully described in the ELECTRICAL REVIEW issue of Aug. 1, last.

Chicago, October 10. L. W. C.

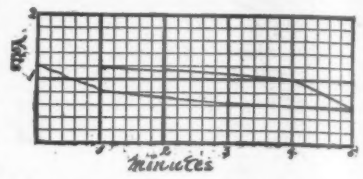
Franklin Experimental Club.

The Franklin Experimental Club, of Newark, N. J., held its first regular meeting since the Summer vacation on Tuesday evening, September 29. There was a good attendance and there is every indication of an increased interest in the Society and its work. The Club is preparing to move into larger quarters, and with a view of increasing largely the growing membership, it has decided to make the initiation fee for the next three months the small sum of $5. The dues are but $1 and $1.50 per month for active and associate members, respectively, and each member is entitled to the use of any and all apparatus, books, papers, use of room by day or night and other privileges of the Society. A large increase in the membership is confidently expected, as the organization has passed the crucial stage.

After the regular meeting on Tuesday evening, the members were entertained by some remarks by President Hammer upon the convention and exhibition of the National Electric Light Association at Montreal. Following this Prof. Geo. C. Sonn gave a most interesting and entertaining talk on his Summer tour in Europe, where he visited the electric exhibition at Frankfort. He also described many things of scientific interest which he saw in the large cities of England, France, Germany, Switzerland, Holland and elsewhere. His remarks were listened to with much interest. The Society then adjourned to meet October 13, at the rooms of the Club. The meetings are held on the second and fourth Tuesdays in the month.

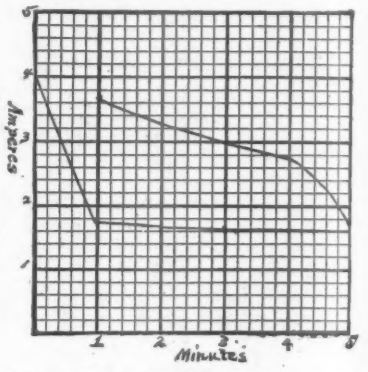
The Gladiator Dry Battery.

The latest dry battery placed on the market is known as the Gladiator, and as a result of thorough investigation and many recent improvements, some extraordinary claims are made for the battery. On open circuit the cell has an electromotive force of 1.6 volts with an internal resistance of



but .4 ohms giving an initial current of 4 amperes. The potential curve on a circuit of 2 ohms external resistance shows an initial electromotive force of 1.2 volts, which at the end of five minutes constant work drops to .62 volts, and recovers to within a fraction of its initial after four minutes' rest.

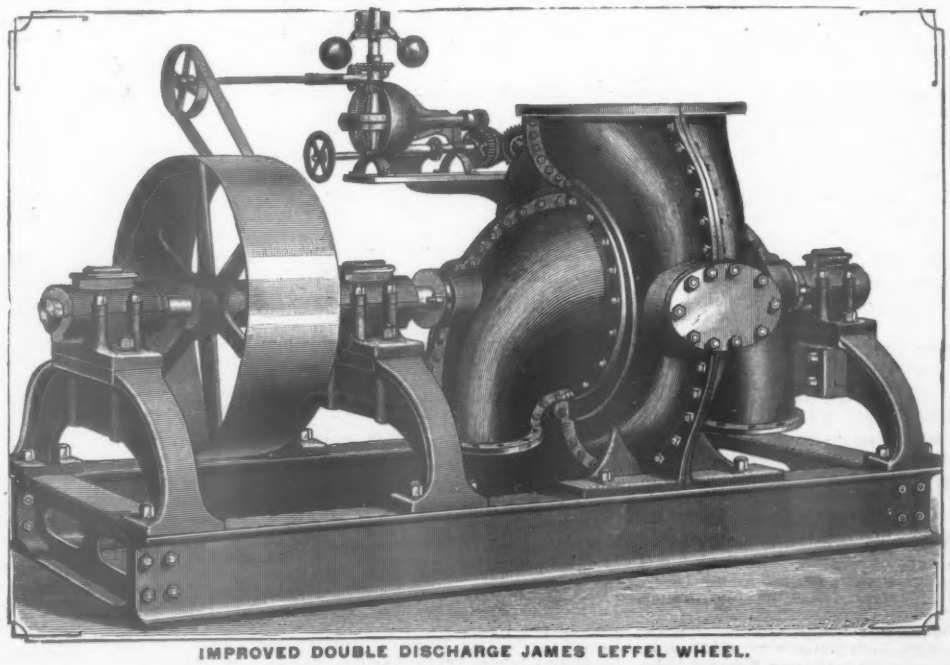
After one minute's work on short circuits the current drops to 1.7 amperes and then falls steadily for four minutes to 1.6 amperes. The recovery line shows that the battery has wonderful recuperative powers, for after standing open for four minutes it recovers to 3.6 amperes. The cell is 6⅞



inches high, 3¼ inches in diameter and weighs exactly three pounds. When allowed to stand open no local action is developed, and the cell does not run itself down without doing useful work.

This battery is being placed on the market by the Central Electric Company, of Chicago, who are the sole agents.

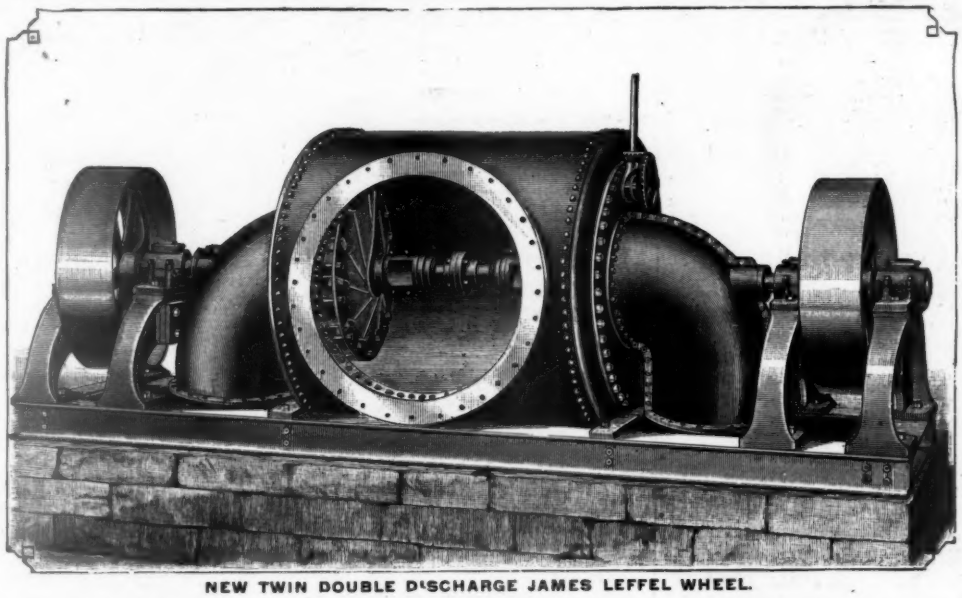
The Gas and Electric Light Company of Franklin, N. H., has just completed a contract with the Edison Company to put in a 45 arc light plant for them. The company has closed a contract with the town to light the village of Franklin Falls with 33 lights, to be run every night until midnight at a rate of $65 per light per year. The contract is for five years.



IMPROVED DOUBLE DISCHARGE JAMES LEFFEL WHEEL.

Leffel Water Wheels.

The James Leffel & Company, Springfield, Ohio, builders of the famous Leffel water wheels, have recently put upon the market the new styles of wheels shown in the accompanying illustrations Fig. 1 shows the most modern of their new double discharge wheels. The principal feature of these is the double discharge, the water being divided equally at the center, and passing parallel with the shaft in opposite directions, discharging downwards on each side of the wheel through curved pipes. The casing



NEW TWIN DOUBLE DISCHARGE JAMES LEFFEL WHEEL.

is made as narrow through the central portion as possible, in order to obtain the shortest distance between the journals, bringing them as near to the wheel as the discharge space will permit, securing a solid and substantial arrangement in the most condensed form.

This wheel is adapted for various purposes, especially where a large amount of power is transmitted from a main horizontal line of shafting, and from the pulleys of which direct connection can be made to one or more pulleys on the horizontal water wheel shaft. A large number of these wheels have been applied recently to electric lighting and electric power stations, running direct from pulleys on the water wheel shaft to the pulleys on the dynamos. In a number of instances pulleys have been used on both sides of the wheel, and in some cases two or more pulleys have been applied to the same side. This wheel is manufactured in all sizes, from the smallest up to 30½ inches.

A new twin, double discharge wheel is shown in Fig. 2. This comprises two standard Leffel wheels discharging in opposite directions, and from each other, the discharge being similar to that of the wheel illustrated in Fig. 1. The illustration in Fig. 3 shows an improved double discharge wheel with a pulley on each side. The principle of discharge is similar to the other two wheels described. A governor attachment is shown in this instance, which has been frequently applied and is often quite necessary, regulating the speed of the wheel when applied to very irregular or intermittent work. A governor can be applied to any of the Leffel wheels, and this illustration shows the general plan of connecting it to the wheel.

This company has met with great success in introducing its water wheels in electric light and power stations where water power is available.

University Extension in Kansas.

Mr. William Beer, librarian of the Free Public Library, at Topeka, Kan., has inaugurated a university extension movement in that city. The first active step is to be a series of lectures on electricity.

Franklin Institute.

The announcement and programme of lectures at the Franklin Institute, Philadelphia, for 1891–2 is out. The electrical section will meet on the first Tuesday of each month, except July and August.

The Story of a Strange Fault.

A fault in a submarine cable has been brought to our notice lately, says the London *Electrical Review*, which possesses some novelty, and, at the same time, brings into view some historical features. Some quantity of small sized submarine cable was purchased a good many years ago in the United States by a Lancashire gentleman who owned some collieries. This cable was stated to have been originally made in England and shipped over to America. A quantity of it was bought by the gentleman we mention and shipped to Lancashire, where it has at times been used in various lengths and for various purposes, formerly for signaling, laterly for telephones, leaving a small surplus of between one and two miles. As some electric lighting had to be done recently about the colliery and the owner's house (the original proprietor who bought the cable has been dead for some time and exact records could not be obtained), it was suggested that some of this cable could be used for a portion of the work where the wires had to be carried underground. Messrs. Mercier, Corlett & Company, of Wigan, who had the work in hand, forwarded this cable to the works of Messrs. W. T. Glover & Company, of Salford, for examination, and repair if necessary.

The cable, in two lengths, both of which were placed in water, was carefully examined and kept there for some time. One piece was found perfectly sound and tested well, giving a good insulation, whilst the other was found faulty with a "dead earth," which was easily localized.

The sound cable, after being put into order for laying down, and the faulty piece, after the bad place had been cut out and the tests showed it again to be good, were sent away.

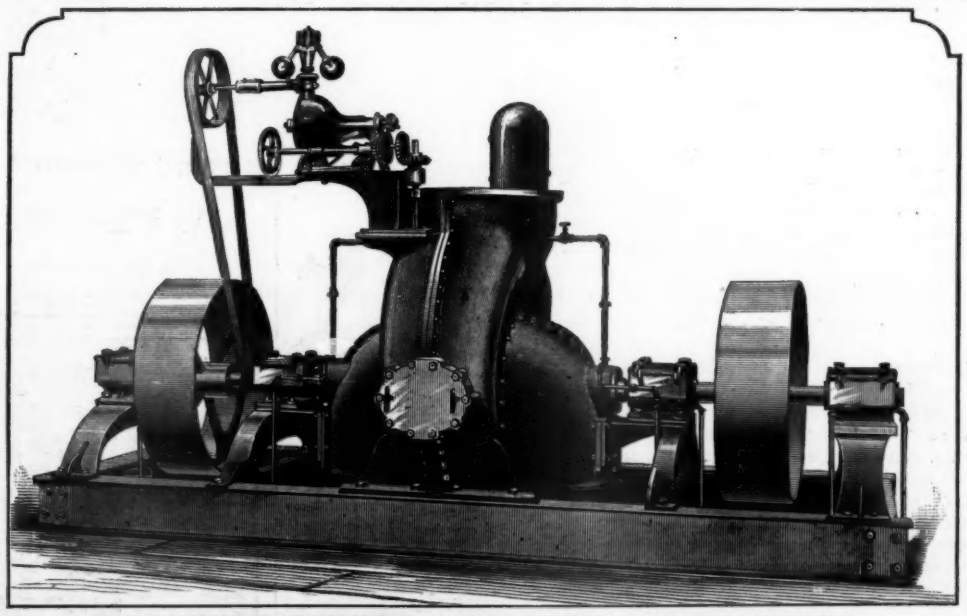
The cable was constructed with a conductor of $\frac{7}{21}$ insulated with gutta-percha. Served with jute yarn and armoured with 18 No. 14½ wires, the fault itself showed full earth, but no disconnection, and although the test for distance was correct, no external signs could be seen to account for the fault. A piece about two yards in length, containing the fault, was cut out, and a portion of the armour taken off, so as to admit of the core being unlaid. On removing the core it suddenly came away clean cut through serving, insulation and conductor, the division being perfectly clean and smooth, and evidently cut by a sharp instrument. On replacing the core exactly as it was originally, and then restoring the armour to its place, it was found on close examination that there was a slight opening between two wires corresponding with the cut. This was evidently caused by a fine sharp narrow chisel, or a similar tool, which had been placed between the wires and driven through the core until it was stopped by the iron wires on the reverse side.

This cable, from the original statement, was purchased in England in 1861, and believed to be made by Glass, Elliot & Company, was shipped to the United States for some special purpose. As the civil war in America broke out in that year, it is not unreasonable to suppose that this cable was employed during the war for either telegraphic, torpedo or mining purposes, by either one side or the other, and that the special section now referred to was in operation. The damage would be probably done by one of the opposing sides, so as to effectually destroy the communication without giving any external signs that the cable was damaged. This supposition appears to be the only one to account for a fault of this character. There is no doubt but that this cable was in the United States during the time of the war. From further inquiries made, it has been ascertained that a cable of this precise type was made in 1861 by Glass, Elliot & Company for some repairs to the Red Sea cable. This cable, about 200 miles in length, was sent out, but all came back again, and was brought to their works at Greenwich, but beyond that we have not been able to obtain definite information. However, the type of cable and its characteristics speak for themselves, and there can be no question but that it was originally made in 1861, underwent many vicissitudes in the United States, and finally returned to England, where, for many years, it remained stowed away in the works connected with a colliery. That it was used in the American war we have no absolute proof, beyond the fact that it was in the States at the time and from the nature of the fault which was clearly malicious.

The sections to which we have referred gave good tests as to insulation, and as the thickness of the dielectric was $\frac{1}{16}$ inch, it was considered safe to place them underground in connection with an electric light circuit. These cables are now working satisfactorily with an alternating current of 2,000 volts.

The fault itself is now in the possession of Mr. W. H. Preece, F. R. S., at the general post office, having been placed in his hands by the writer, who has had in the past an extensive experience of cable faults.

The editor of the *Electrical Review*, commenting on the above, writes: "In an article in this week's issue on a peculiar fault found in a submarine cable, there are two points which strike our attention as being of great interest. The first is that a cable, originally intended to be used for telegraphic communication in the Red Sea in 1861, should now, in 1891, be found suitable to form part of an electric light circuit working under high pressure. The second is that a conductor, insulated with gutta-percha, should, after so many vicissitudes, and after a life of 30 years, be found electrically suitable for working with a current of so high a potential as 2,000 volts. Surely there are not many instances where the durability of gutta-percha has come out so strongly. This speaks well, not only for the quality of the material used, but also for the excellence of the manufacture. Who amongst us will venture to say that vulcanized rubber will show a life equally long."—*The London India Rubber and Gutta-Percha and Electrical Trades Journal.*



SINGLE COMBINATION IMPROVED DOUBLE DISCHARGE. GOVERNOR ATTACHMENT.

KINDRED INTERESTS

Hammacher, Schlemmer & Company, 209 Bowery, New York, have issued a most complete illustrated catalogue of tools of all kinds.

The Western Electric Company have sent us a photo *fac-simile* pocket edition of their illustrated general catalogue recently mentioned in this column.

The C. W. Hunt Company, 45 Broadway, New York, has issued a very complete and handy series of catalogues of coal handling machinery, conveyors, etc. The catalogues come in a neat case.

"How to Keep Boilers Clean" is the title of a neat pamphlet issued by James F. Hotchkiss, 112 Liberty street, New York. The Hotchkiss mechanical boiler cleaner is also illustrated and described.

Benjamin Blum, of Blum & Hess, New York, general export agents for Wenstrom apparatus, has taken an order for and shipped one 450 light direct current Wenstrom dynamo for an isolated plant in Montreal.

The Buckeye Engine Company, Salem, O., have sent us part third of their catalogue describing their well known compound engines. Detail drawings and profuse descriptions give one a thorough understanding of the engines.

Chas. A. Schieren & Company, New York, have received an order from the Diamond Electric Company, Seventeenth and Clearfield streets, Philadelphia, Pa., for two 30 inch double belts, one 16 inch double, one 15 inch double, two 12 inch doubles, and four 11 inch double belts for their new power plant. The demand for their patent perforated electric belting continues to increase; especially is the demand increasing for this belting for use in electric street railway work, where it is found very desirable, because it can be run more slack than any unperforated belt without slipping. No charge is made for the perforations—they are given gratis.

The Falls Rivet and Machine Company, Cuyahoga Falls, O., have equipped with their friction clutches and other devices the following electric plants, among others: Masonic Temple, Chicago, Ill.; Beaver Valley Traction Company, Beaver Falls, Pa.; Reading Electric Light and Power Company, Reading, Pa.; Davenport Gas Light Company, Davenport, Iowa; Cincinnati Street Railway Company, Pendleton street station, Cincinnati, O.; Louisville Electric Light and Power Company, Louisville, Ky.; Louisiana Electric Light Company, New Orleans, La.; Pulaski Electric Light Company, Pulaski, Tenn ; Wheeling Electric Light Company, Wheeling, W. Va.; Brush Electric Light Company, Cleveland, O.; Pittsburgh Plate Glass Company, Ford City, Pa.; Cedar Rapids Electric Light and Power Company, Cedar Rapids, Iowa; Belt Electric Line Company, Lexington, Ky.; Covington Electric Light Company, Covington, Ky.; Indiana Electric Light Company, Indiana, Pa.; Municipal Electric Lighting and Power Company (addition), St. Louis, Mo.

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Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 8 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 8 ft., with tapes attachment; 22 in. x 13 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 18 ft.; 36 in. and 38 in. x 30 ft.; 42 in. x 12 ft.; 56 in. x 18 ft.; 72 in. x 30 ft.; 108 in. x 22 ft. Fox Lathes, 18 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.
Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 72 in. x 60 in. x 15 ft.; 72 in. x 60 in. x 20 ft.
Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.
Crank Shapers, 6 in., 8 in., 10 in., 13 in., 15 in., 16 in., 20 in., 24 in., 28 in.
Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.
Screw Machines, Nos. 5, 6, 7, 8, Power Feed.
Presses, Nos. 51, 52, 53, Ferracute, Nos. 1, 2, 3, Stiles & Parker.
20 Lincoln Pattern Millers, No. 2.
Hand Millers, Nos. 1 and 2. 3 Cam Cutters.
Bolt Cutters, ¼ in. to 1 in., ¼ in. to 2 in.
2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.
1 New Horizontal Boring Machine. Newark Machine Tool Co.
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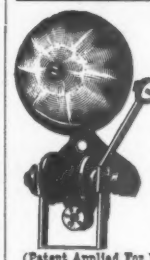

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IF YOU have anything pertaining to electric machinery you want to sell, send us the description.
IF YOU want anything pertaining to electric machinery, send us your inquiries.
FRANK RIDLON & CO.,
Dealers in New and Second-Hand
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WANTED.—ELECTRICIAN. A manufacturing concern in Chicago, having large isolated plant, want to engage a competent man to take charge of same. Must be not over 40 years old, acquainted with leading systems of arc and incandescent lighting, competent to lay out and do new wiring, and a good all-around man.
Please address in own handwriting, stating full particulars as to age, experience, salary wanted, etc.
"MANUFACTURER,"
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Double Cylinder Battery.

Surface of negative element and quantity of solution double that found in any other open circuit cell.
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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON SEPTEMBER 29, 1891.

460,503 Electric bell; Walter Hay, Chicago, Ill., assignor of one-half to George E. Horn, same place.
460,504 Apparatus for holding and sewing carpets. 460,505 460,506 460,507 460,508 Apparatus for holding and sewing fabrics; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Union Special Sewing Machine Co., of Illinois.
460,514 Electric crane; William A. Stadelman, Philadelphia, Pa., assignor to the Equitable Engineering and Construction Co., same place.
460,524 Electrical railway signaling apparatus. 460,525 Electric railway signal; William F. Z. Desaut, New York, N. Y.
460,538 Thermal cut-out; John O. Phillips, New York, N. Y.
460,541 Electric elevator; Rudolph C. Smith, Yonkers, N. Y., assignor, by mesne assignments, to the National Co., of Illinois.

ISSUED OCTOBER 6.

460,571 Turn-out or switch for trolley wires; Daniel W. Edwards, Saginaw, Mich., assignor to the Murray Overhead Trolley Switch Co., same place.
460,572 Printing telegraph; Moses G. Farmer, Eliot, Me.
460,587 Electric arc lamp. 460,680 Arc lamp electrode; Hosea W. Libbey, Boston, Mass.
460,595 Arc lamp pencil; Isaiah L. Roberts, Brooklyn, assignor to the Roberts-Brevoort Electric Co., Ltd., New York, N. Y.
460,596 460,597 Electrode for arc lamps; Isaiah L. Roberts, Brooklyn, N. Y.
460,599 Electrode for secondary batteries; Wm. A. Rosenbaum, Jersey City, N. J.
460,606 Electric conductor. 460,607 Conduit for electric wire; William Vogler, Somerville, Mass.
460,614 Regulating the speed of electric motors.
460,615 Rail connection for electric railways; Merle J. Wightman, Scranton, Pa.
460,618 Electric switch; Charles Wirt, Chicago, Ill., assignor to the Electrical Supply Co., of Illinois.
460,619 Steno-telegraphic apparatus; Alexander Wood, Philadelphia, Pa.
460,634 Trolley wire support; Thomas Fricker, Ashtabula, O., assignor of one-half to L. W. Smith and J. L. Smith, same place, and Sarah A. Reed, Erie, Pa.
460,650 Millampere meter; Lyman D. McIntosh, Chicago, Ill.
460,652 Globe protector for electric arc lamps; Edward J. Openlander, St. Louis, Mo., assignor of one-third to John C. King, same place.
460,653 Hydro-carbon burner; William F. Olis, Norwalk, O.
460,695 Electrically controlled cutting device; Le Roy S. White, Waterbury, Conn., assignor to himself and Samuel A. Chapman, same place.
460,701 Automatic safety cut-out; William B. Cleveland, Cleveland, O.
460,725 Insulation for electric wires; John R. Markle, Detroit, Mich.
460,735 Trolley wire support; Nelson Weeks, Jr., Long Island city, N. Y.
460,765 Composition for insulating material; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.
460,767 Central station apparatus for call boxes; Edmund R. Wilder, Kansas City, Mo.
460,771 Telegraph block system of railway traffic control; David C. Coombes, Lewisham, near Sydney and William Rowe, Warrickville, near Sydney, New South Wales.
460,779 System of electrical signaling for railroads; Simon de Jager and Albertus Zoutman, Denver, Colo.
460,780 Underground railway conduit. 460,781 Electric railway trolley; Emil E. Keller, Chicago, Ill.
460,831 Iron or steel telegraph or other post; William E. Pedley, Prescott, Ariz.
460,864 Automatic electric switch indicator; Everet W. Hadley, Corvallis, Ore.
460,887 Electric railroad; Ira Robbins, Sheffield, Ala.
460,895 Electrical alarm; Homer P. Smith, Neenah, Wis.
460,926 Core for electric solenoids; John T. Williams, Mount Vernon, assignor to the International Portelectric Co., New York, N. Y.

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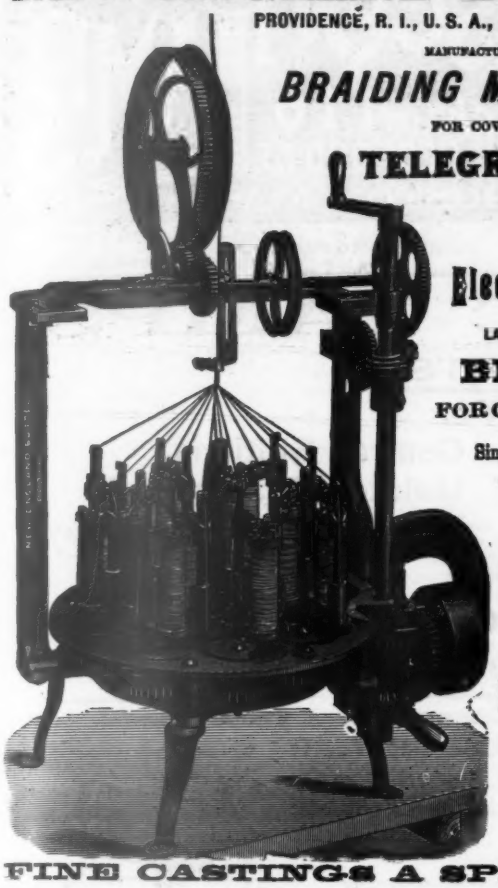

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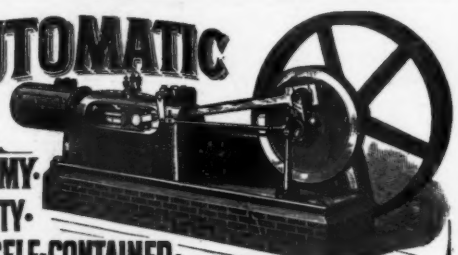

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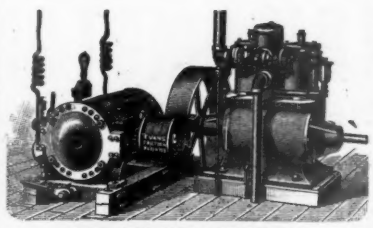

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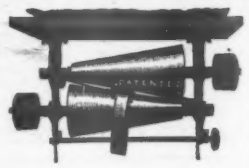

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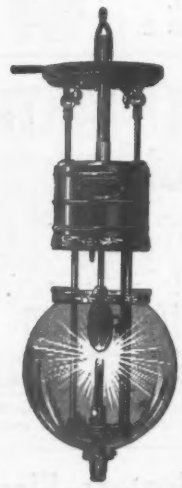

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